MOOG

IDBS

USER'S MANUAL (rev.4)

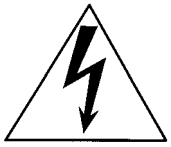
INDEX OF REVISIONS

Revision	Date	Description	Updated section
1	Mar 01	Initial Release	All
2	May 02	Ugrade with new drives and new SW release	All
3	Feb 03	Add Section 6; correct miscellaneous errors	I – 1, 2, 4, 7 to 18; II – 5, 11, 12; VI - all
4	Jan 06	New IDBS 100/320 Correct miscellaneous errors	1,2,3 All

INDEX OF CONTENTS

I.1 ACCIDENT PROTECTION

The safety instructions provided in this Manual are included to prevent injury to personnel (WARNINGS) or damage to equipment (CAUTIONS).



***WARNING**: High Voltage. Bus Bar's can have voltage ≥810Vdc even after switching off (capacitive voltage).*
Discharge Time approx. 6 Minutes.

***WARNING**: High Voltage. The recovery resistor is connected to the Bus Bar's and can have voltage ≥810Vdc.*

***WARNING**: do not touch recovery resistor during operation to avoid scalds*

***CAUTION**: make sure that the correct input voltage, 400V or 460V, has been set*

***CAUTION**: it is recommended to disconnect the drive and the EMC filters to carry out the AC Voltage Tests of EN 60204-1 (1997), par.19.4, in order to not damage the Y-type capacitors between phases and ground. Moreover the DC voltage dielectric test required by EN 50178 (1997), product family standard, has been carried out in factory as a routine test. The DC Insulation Resistance Tests of EN 60204-1 (1997), par.19.3, may be carried out without disconnecting the drive and the EMC filters.*

***CAUTION**: when required for an emergency stop, opening U2-V2-W2 pins and closing motor phases to resistors, must be preceded by disabling the axis. The delay time must be at least 30 ms.*

***CAUTION:** in case of repetitive switching on and off, wait 1 minute between on and on.*

***CAUTION**: the cooling circuit of IDBS W120/240 must be kept clean. Cooling media must not contain particles that may deposit causing obstruction to cooling circuit. We recommend to check periodically cooling flow.*

***CAUTION**: do not exceed the tightening torque of the table (but see proper data sheets for the tightening torque of input capacitors and power modules and see Section 2 of this Manual for the tightening torque of terminal blocks)*

Screw Thread	Tightening torque [Nm]	[lb in]
M3	1.00	8.85
M4	3.00	26.55
M5	6.00	53.10
M6	8.00	70.80
M8	20.0	177.0

I.2 EC DECLARATION OF CONFORMITY

CENELEC Memorandum N°3

EC DECLARATION OF CONFORMITY

The undersigned, representing the following manufacturer

MOOG ITALIANA S.r.l., Casella Site
Via Avosso 94, Casella (Genova), Italy

herewith declares that the products

Complete Drive Modules series: BRD-4S, DBC III, DBS, IDBS, DS2000, PDBS Basic Drive Modules series: BRM-4S, DBM 03, DBM 04, IDBM 04, DBM 033 Feeding sections series: ADR, BRM-P1, BRM-P2, DBM 03-PS, DBM 04-PS, DBM 033-PS Motor groups series: FAE F/K/N/T/W, FAS F/K/N/T/W, FC

are in conformity with the provisions of the following EC directives
(including all applicable amendments)

ref. n°	title
73/23/EEC	Low Voltage Directive
89/336/EEC	EMC Directive

and that the following harmonized standards, or parts thereof, have been applied

nr	issue	title	parts
EN 60034-1	1998	Rotating electrical machines. Part 1: Rating and performance	
EN 60034-6	1993	Rotating electrical machines. Part 6: IC code	
EN 60034-7	1993	Rotating electrical machines. Part 7: IM code	
CEI EN 60204-1	1993	Safety of Machinery. Electrical Equipment of machines. Part 1: General requirements	par. 6.2.3, 20.3, 20.4
EN 60529	1991	IP code	
CEI EN 61800-3	1996	Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods	par. 1, 2, 3, 4, 5.3.2, 6.3.2, 7
EN 61800-3 /A11	2000	Amendment A11	

Other references or information required by the applicable EC directives:
The conformity of products is subjected to the installation of filters and to the procedures included in the proper "Installation Manual". The user has the primary EMC responsibility in following the recommendations of the manufacturer.

Last two digits of the year in which the CE marking was affixed: 97

Casella, 12/July/2005

A.Bazurro
PRODUCTION MANAGER

DEC_CEME Casella.DOC - MOD.176/PMA/9/96

I.3 EC REQUIREMENTS

- **Cautionary Marking.** See previous page.

- **Protection against electric shock**. Electronic Equipment intended for installation in closed electrical operating areas kept locked. The lock shall be only opened by authorized person and the access only allowed to skilled persons whilst energized. Where the equipment requires manual intervention, 412.2.1 of HD 384.4.41 S2 shall be consulted.

- **Fixed connection for protection**. The equipment may have a continuous leakage current of more than a.c. 3.5 mA or d.c. 10 mA in normal use and a fixed ground connection is required for protection.

- **RCD**. A d.c. component can occur in the fault current in the event of a fault connection to earth. Only a residual-current-operated protective device (RCD) of Type B is allowed. When the protection in installations with regard to indirect contact is achieved by means of an RCD, their appropriate function/combination shall be verified.

- **Climatic Conditions.** Equipment intended to operate within its performance specification over the range of Class 3K3, as defined in table 1 of EN 60721-3-1, EN 60721-3-2, EN 60721-3-3, EN 60721-3-4, partly modified.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

- **EMC Requirements.** The installer of the equipment is responsible for ensuring compliance with the EMC standards that apply where the equipment is to be used. Product conformity is subjected to filters installation and to recommended procedures, as from Section 3 of this Manual.

- **Second Environment (EMC)**. Equipment intended to be connected to an industrial low-voltage power supply network, or public network which does not supply buildings used for domestic purposes (second environment, according to EMC Standards).
  It is not intended to be used on a low-voltage public network which supplies domestic premises (first environment). Radio frequency interference is expected if used on such a network.

- **Recovery Resistor Cable.** Shielding of the recovery resistor cable, provided in kit for test purposes, is recommended for ensuring compliance with the EMC standards.

- **Large-Scale Stationary Industrial Tools (WEEE, RoHS).** Equipment intended for installation as part of large-scale stationary industrial tools, covered by the exception of Annex IA, No.6, of the European Directives 2002/96/EC (WEEE) and 2002/95/EC (RoHS).

I.4 UL AUTHORIZATION (page 1)

UL International Italia S.r.l.
Via Archimede 42
I–20041 Agrate Brianza (MI)
Italy
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e-mail: info.it@it.ul.com
www.ul-europe.com

An Affiliate of Underwriters Laboratories Inc.®

NOTICE OF AUTHORIZATION TO APPLY THE UL LISTING MARK

January 09th, 2006

Attn.: Ing. Daniele Rolla

MOOG Italiana S.r.l.
Casella Site
Via Avosso, 94
16015 Casella (Genova) - Italy

Fax Number: 010-9671283
E-mail: drolla@moog.it

Reference: File E194181 - Vol. 1, Sec. 1-2-3 Project 05CA22929 (P.O. Number 05IT0804)

Subject: Industrial Control Equipment,
Listed – Power Conversion Equipment - (NMMS) (NMMS7) - cULus

- Revised Report for Open Type, Brushless Motor Servo-Drives "DS 2000 Series – Size E" (Vol.1 –Sec.1)
- Revised Report for Open Type, Brushless Motor Servo-Drives "DS 2100 Series – Size E" (Vol.1 –Sec.3)
- Revised Report for Open Type, Brushless Motor Servo-Drives "DBS Series – 100/320" (Vol.1 –Sec.2)

Dear Ing. Daniele Rolla,

UL's investigation of your product has been completed under the above project number and the subject product was determined to comply with the applicable requirements.

This letter temporarily supplements the UL Follow-Up Services Inspection Procedure and serves as authorization to apply the UL and C-UL Listing Mark (cULus), only at the factories under UL's Follow-Up Service Program, to the above products, which are constructed as described below:

- Identical to the subject model, which was submitted to UL for this investigation. The UL Records covering the product will be in the Follow-Up Services Procedure, File E194181, Volume 1, Section 1 -2 - 3.

To provide the manufacturer with the intended authorization to use the UL and C-UL Listing Mark (cULus), the addressee must send a copy of this Notice and all attached material to each manufacturing location as currently authorized in the appropriate UL File Procedure.

This authorization is effective from the date of this Notice and only for products at the indicated manufacturing locations. Records in the Follow-Up Services Procedure covering the product are now being prepared and will be sent to the indicated manufacturing locations in the near future. Please note that Follow-Up Services Procedures are sent to the manufacturers only unless the Applicant specifically requests this document.

UL AUTHORIZATION (page 2)

UL International Italia S.r.l.
Via Archimede 42
I–20041 Agrate Brianza (MI)
Italy
Tel: +39 039 6410 101
Fax: +39 039 6410 600
e-mail: info it@it ul com
www.ul-europe com

An Affiliate of Underwriters Laboratories Inc.®

Please note: Within Canada, there are federal and local statutes and regulations requiring the use of bilingual product markings. It is the responsibility of the manufacturer (or distributor) to comply with this law. As such, the markings provided in the UL Follow-Up Service Procedure may include only the English version. Please contact us if you need assistance with translations or in determining which markings are appropriate for your product.

Products produced, which bear the UL Listing Mark, shall be identical to those evaluated by UL and found to comply with UL's requirements. If changes in construction are discovered, appropriate action will be taken for products not in conformance with UL's requirements and continued use of the UL Listing Mark may be withdrawn or products that bear the UL Listing Mark may have to be revised (in the field or at the manufacturer's facility) to bring them into compliance with UL's requirements.

Any information and documentation provided to you involving UL Mark services are provided on behalf of Underwriters Laboratories Inc.

Sincerely,

Giuseppe Redaelli
Senior Project Engineer
UL International Italia Slr
Tel: 0039-039-6410101
Fax: 0039-039-6410600
E-mail: giuseppe.redaelli@it.ul.com

Reviewed by:

Matteo Redaelli
Engineering Team Leader
UL International Italia Slr
E-mail: matteo.redaelli@it.ul.com

I.5 UL REQUIREMENTS

- These Brushless Servo-Drives shall be assembled with the guidelines specified in this Manual. Only the configurations with the components tested and described in the UL Report, file E194181, Vol.1, Sec.2, Issue date 06-09-00 and following Revisions can bear the Listing Mark.

- These drives shall be used within their ratings, as specified in the marking of the equipment.

- **Cautionary Marking.** See Accident Protection page.

- **Surrounding Air Temperature** - *"Maximum Surrounding Air Temperature 40°C".* In the final installation considerations shall be given for the need of repeating Temperature test if the unit is mounted with a different Surrounding Air conditions.

- **Pollution degree 2 Installation** - The drive must be placed in a pollution degree 2 Environment.

- **Environmental designation** - *"Open Type Equipment"*.

- **Short Circuit Ratings**.

  1. IDBS 3/9, 6/15, 15/42, 25/70, 35/90, 50/140*: "Equipment suitable for use on a circuit capable of delivering not more than 5000 rms Symmetrical Amperes, 460 V ac +10% maximum"*
  2. IDBS 60/180, 100/240, W120/240, 100/320, 180/320*: "Equipment suitable for use on a circuit capable of delivering not more than 10000 rms Symmetrical Amperes, 460 V ac +10% maximum"*

- **Branch Circuit Protection**. The Branch Circuit Protection for Short Circuit shall be provided in the end-use applications by external R/C Fuses (JFHR2), manufactured by Bussmann Div Cooper (UK) Ltd, Semiconductor fuse type, rated 660 Vac, 200 kA A.I.C., Mod.No. as follows:

  1. IDBS 3/9, 6/15, 8/22, 15/42: Mod.No. 50 FE, rated 50 Amps
  2. IDBS 25/70, 35/90: Mod.No. 100 FE, rated 100 Amps
  3. IDBS 50/140, 60/180: Mod.No. 160 FEE, rated 160 Amps
  4. IDBS 100/240: Mod.No. 280 FM, rated 280 Amps
  5. IDBS W120/240: Mod.No. 315 FM, rated 315 Amps
  6. IDBS 100/320 , 180/320: Mod.No. 500 FMM, rated 500 Amps

- **Overspeed Protection**. The Power Conversion Equipment is incorporating an Overspeed Protection. See MV command in Section 5 of this Manual.

- **Overvoltage Control**. In the equipment the Overvoltage is controlled by a Transient Suppressive device, with 1500 V Clamping Voltage and min 120 J (10x1000 us or 2 ms) Energy Handling Capability. See also "Bus not normal" protection in Section 4 of this Manual.

- **Overload Protection**. The equipment does not incorporate internal overload protection for the motor load. The drive is intended to be used with motors that must have integral thermal protection through a PTC. The overtemperature fault of the drive will trip when the PTC reaches 1.2 kΩ. See J4 connector in Section 2 of this Manual for wiring.

- **Over-Current Protection**. The drive is provided with a current limiting circuitry. See IL and IT commands in Section 5 of this Manual.

- **Wiring**. Wiring shall be made by stranded and/or solid, copper (Cu), 60/75°C (140/167°F) conductor only, and, for terminal blocks, the tightening torque values specified in Section 2 of this Manual shall be applied. These requirements do not pertain to control circuit terminals.

- **Wiring of Recovery Resistor**. The Dynamic Brake Unit Recovery Resistor, when external, shall have the connection wiring made with R/C (AVLV2) or insulated with R/C (YDPU2) or R/C (UZCW2) in the end-use installation.

I.6 ICEPI CERTIFICATE

Istituto Certificazione Europea Prodotti Industriali s.r.

ATTESTATO DI ESAME VOLONTARIO
VOLUNTARY EXAMINATION CERTIFICATE

05CM020302

■ Nome e indirizzo del detentore del certificato ❑ *Name and address of the holder of the certificate*	**MOOG Italiana S.r.l. Electric Division Via Avosso, 94 16015 CASELLA (GE)**
■ Costruttore ❑ *Manufacturer*	**MOOG Italiana S.r.l. Electric Division Via Avosso, 94 16015 CASELLA (GE)**
■ Genere prodotto ■ *Product designation*	**Servoazionamento digitale monoasse *Single axis digital servodrive***
■ Serie \ Opzione ❑ *Series \ Option*	**IDBS \ DRC - SRC**
■ Funzione di sicurezza ■ *Safety function*	**Interblocco al riavvio (protezione contro l'avvio inaspettato) *Restart interlock (protection against unexpected start)***
■ Direttiva(e) CE \ Norma(e) armonizzata(e) ❑ *EC - Directive(s) \ Harmonized standard*	**98/37/CE (Macchine) \ UNI EN 954-1: 1998**

■ Risultato dell'esame
■ *Examination result*

L'esame del Fascicolo Tecnico permette di dichiarare che la funzione di sicurezza "interblocco al riavvio", dopo un arresto controllato (categoria 1 CEI EN 60204-1:1998), del servoazionamento serie IDBS, con opzione
- DRC rispetta i requisiti della categoria 3 definita nella norma armonizzata UNI EN 954-1:1998;
- SRC rispetta i requisiti della categoria 2 definita nella norma armonizzata UNI EN 954-1:1998.

I servoazionamenti devono essere installati come descritto nel Manuale Istruzioni (condizioni ambientali e interfaccia con il sistema di comando e controllo).

Following the examination of technical construction file we can declare that the safety function "restart interlock", after a controlled stop (category 1 CEI EN 60204-1: 1998), of servodrive IDBS series, with option
- DRC complies with the provisions of category 3 as defined in the harmonized standard UNI EN 954-1: 1998;
- SRC complies with the provisions of category 2 as defined in the harmonized standard UNI EN 954-1: 1998.

Servodrives must be installed according to the instructions (environmental and interface with control and verification circuit) of the User's Manual.

Pontenure, 12.02.2003

Il Direttore Generale
Ing. Andrea Guido Esposito

via Emilia Parmense, 11/A • 29010 Pontenure (PC) • Italy
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I.7 SAFETY (RESTART INTERLOCK FUNCTION) REQUIREMENTS

- **Controlled Stop Time**. The final machine must be able to stop the motors in less than 360 ms. The hazard/risk assessment of the application must demonstrate that within this time persons cannot be injured. The drive can provide the Anti Free Wheeling function to perform the controlled stop.

- **Free-Wheeling Detection**. The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. This system must have the motor velocity available.

  ***WARNING**: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

- **Environmental Conditions.** Equipment intended to operate within the following environmental conditions:
  - ◊ Ambient temperature: 0 to 40°C
  - ◊ Supply voltage interruptions: 10, 20, 500 ms dip time
  - ◊ EMC immunity: according to EN 61000-6-2:1999 (Generic Standard - Immunity for industrial environment)
  - ◊ Vibration: 2 to 9Hz, 3.0 mm amplitude (peak); 9 to 200Hz, 1 g acceleration
  - ◊ Shock: 10 g, half sine, 6 ms

- **Enclosure.** Electronic Equipment intended for installation in an enclosure providing at least IP54 protection.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

***WARNING**: When the Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

I.8 LEGAL ASPECTS

This manual can be used only by final Customers/Users of the Moog product it describes and only for proper installation purposes.
This manual cannot be reproduced in whole or in part without the prior written consent of Moog.
No transmission or diffusion of this manual, under electronic, mechanical, or printed form, is allowed.
Moog issued this manual attempting to ensure a complete information; anyway, Moog shall not be liable for errors or omissions contained herein and for incidental or consequential damages due to the above mentioned errors and omissions.
Moog reserves the right to change and update this manual without notice.
This manual has a merely information purpose. There is no obligation for Moog as regard the correspondence of the product features described in the manual with the features of the real product purchased by the final Customer/User.
No statement or sentence contained in this manual implies further legal obligations different from the ones contained in each single sale or supply contract concerning Moog products.

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1. DESCRIPTION

1.1 INTRODUCTION

IDBS servodrives position themselves in the range of very high performance converters thanks to optimized design using advanced power and digital electronics. The result is true added value for the users who appreciate its unrivaled flexibility and reliability.
A microprocessor based structure allows high servo performances with FAS T, FAS K, FAS N and FC servomotors which are all equipped with a resolver feedback.
Drive tuning and configuration are performed via digital parameters (not potentiometers) and stored in nonvolatile memory (Flash Disk).
Drive set is possible via PC, therefore simplifying installation and providing easy fault diagnosis.

1.2 GENERAL FEATURES

- built-in power supply
- digital speed loop
- sinusoidal current waveform
- SMD technology with control boards automatically assembled and tested
- automatic resolver to digital (R/D) resolution switching (from 16 to 10 bit) to achieve high motion accuracy in the whole speed range (from 0 to 10000 rpm)
- 5/10 kHz switching frequency
- maximum case depth 310 mm
  (370 mm for IDBS 100/240, IDBS 100/320, IDBS 180/320)
  (325 mm for IDBS W120/240)
- programmable gains of the speed and current loops programmable digital filters
- built-in fans
- built-in soft start electronic circuit
- intelligent IGBT (IPM) power bridge
- constant motor torque in the whole speed range thanks to dedicated software algorithm
- indirect field oriented control (IFOC) for squirrel cage induction motor

1.3 OPTIONS

- software programmable (from 64 to 16384 pulses per electrical revolution) simulated encoder with marker pulse
- A/D 14 bit converter on the analogic input as alternative to the standard 12 bit version
- 4 arc/min R/D converter resolution
- 24 Vdc auxiliary power supply voltage
- DRC (Dual -channel Restart interlock Circuit) safety function. See Section 6.
- SRC (Single-channel Restart interlock Circuit) safety function. See Section 6.

1.4 DIMENSIONS AND DRILLING JIG

FIG.1.1 to Fig.1.4A (dimensions in mm) shows the dimensions and the drilling jig of the drive.
Leave a clear space of at least 50 cm (19.7 in) over and under the system for air circulation.

FIG. 1.1 IDBS 3/9 to 60/180 - Dimensions and Drilling Jig (Drill For M5 Screws)

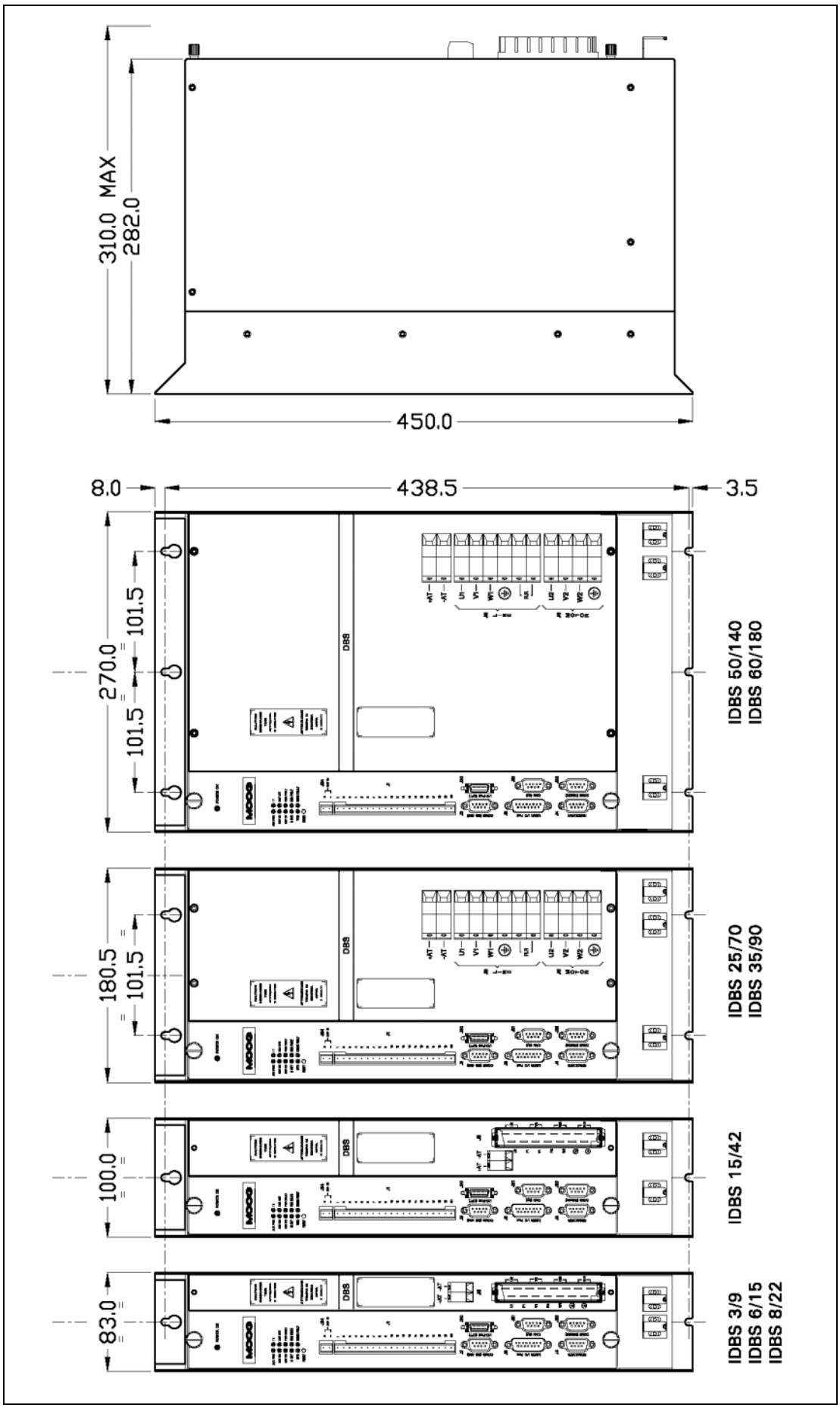


FIG. 1.2 IDBS 100/240 - Dimensions and Drilling Jig (Drill For M5 Screws)

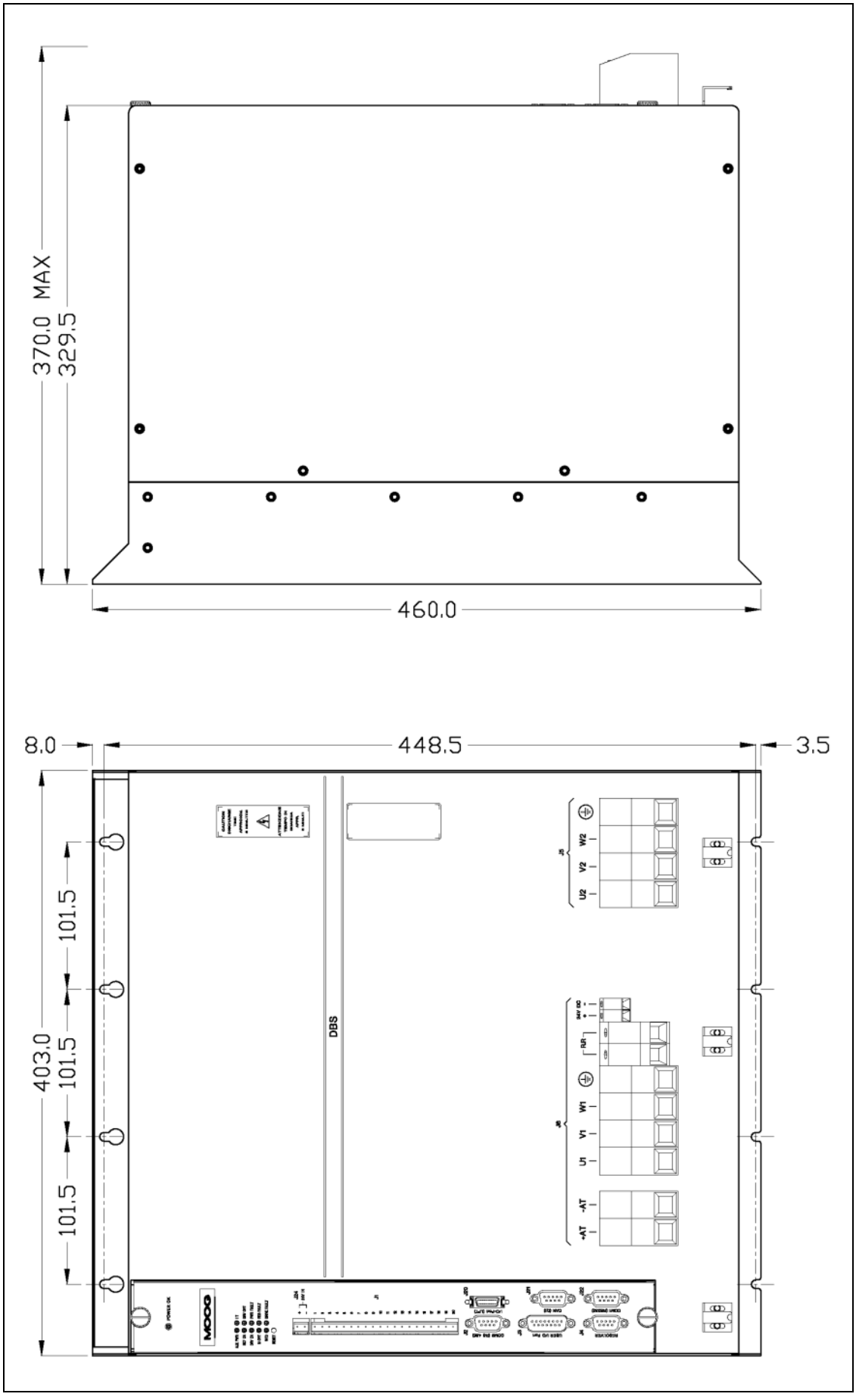


FIG. 1.2A IDBS 100/320 - Dimensions and Drilling Jig (Drill For M5 Screws)

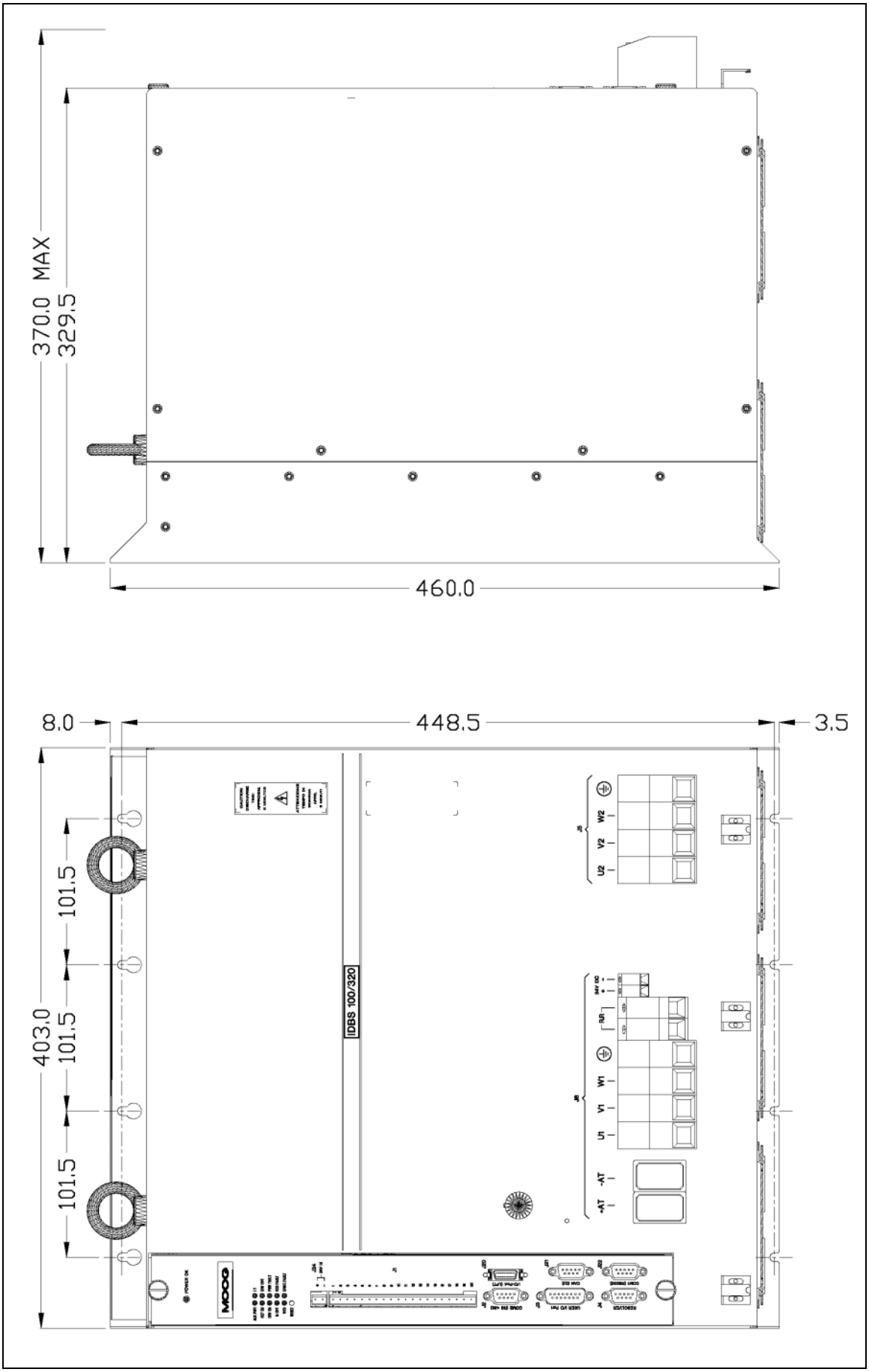


FIG. 1.3 IDBS 180/320 - Dimensions and Drilling Jig (Drill For M5 Screws)

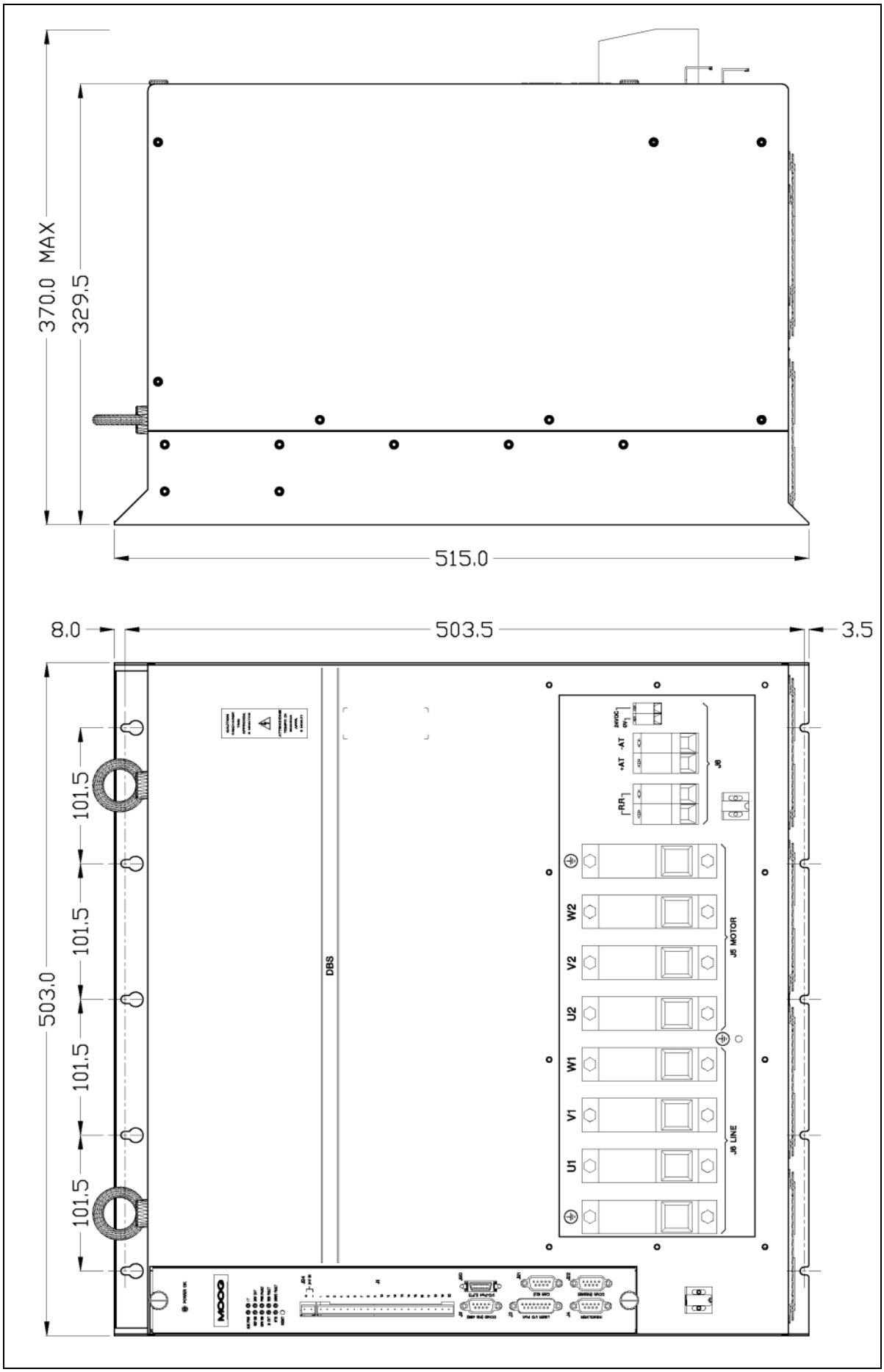


FIG. 1.4A IDBS W120/240 - Dimensions and Drilling Jig (Drill For M5 Screws)

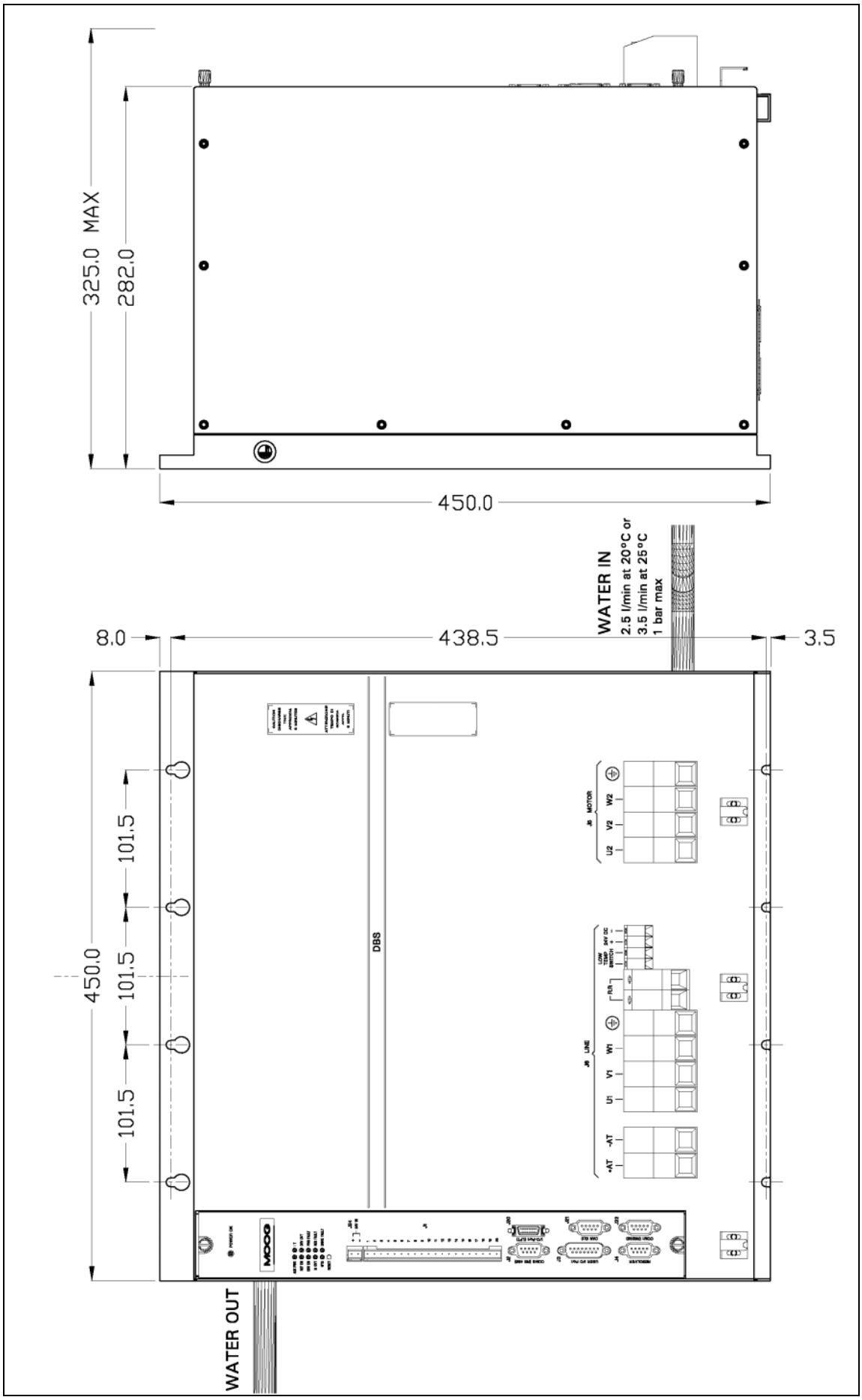
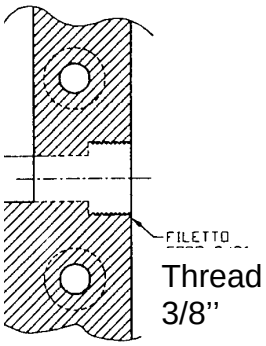
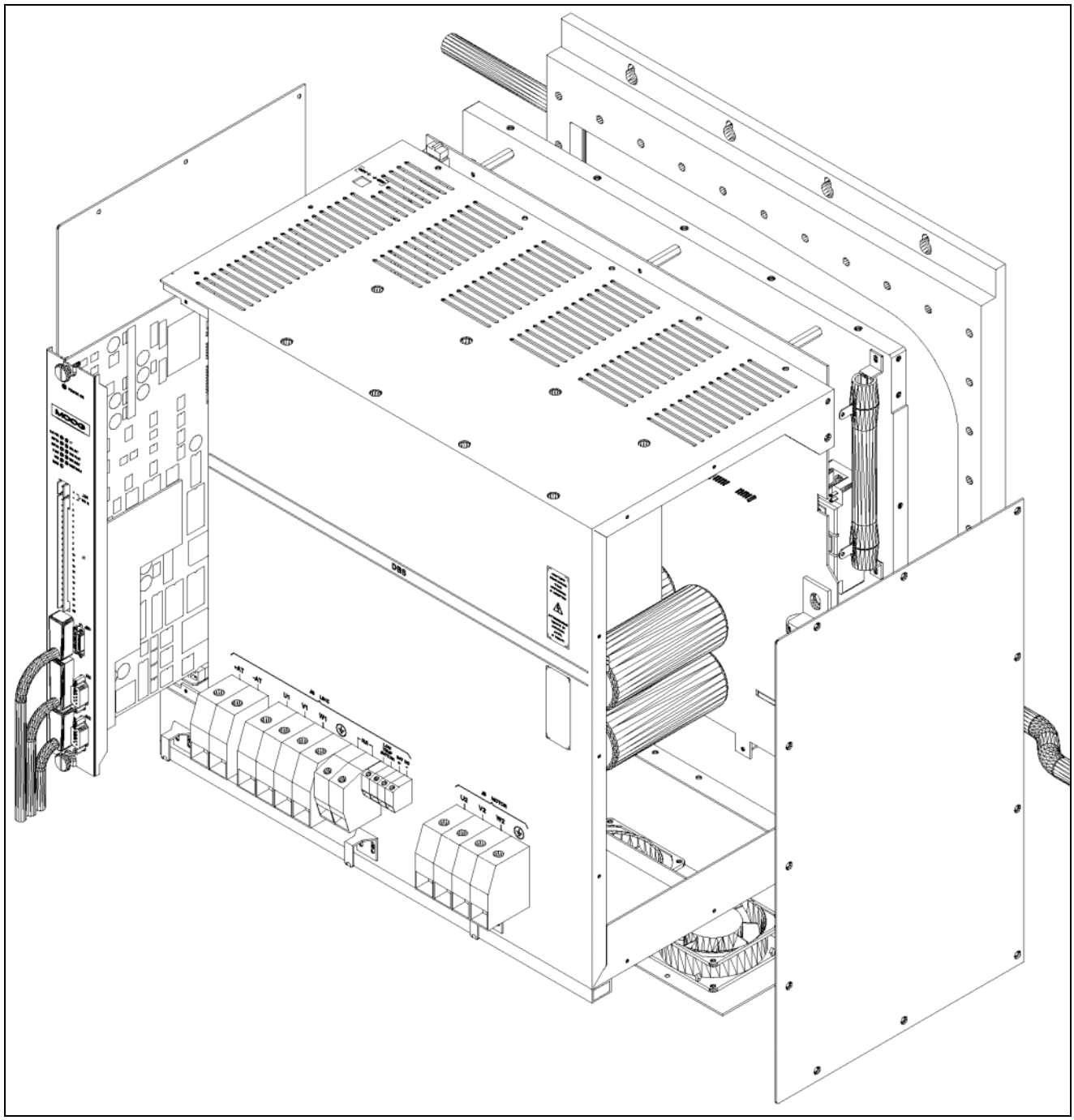


FIG. 1.4B IDBS W120/240 - Water Ports



CAUTION: *the cooling circuit must be kept clean. Cooling media must not contain particles that may deposit causing obstruction to cooling circuit. We recommend to check periodically cooling flow. The cooling circuit must be kept clean.*

FIG.1.5 IDBS W120/240 - Component Identification



1.5 TECHNICAL DATA

Nominal input voltage: 400 or 460 Vac ±10%, 50/60 Hz, selectable via switch
Min/max input voltage: 360 / 506 Vac
Three-phase output voltage: 325 (with 400Vac) or 375 V (with 460Vac)
Output current: see following chart
Switching frequency: 10 kHz (5 kHz over 60/180 A size)
Operating temperature: 0 to +40°C (exceeding Class 3K3)
Relative humidity: 5% to 85% (no condensation/ formation of ice) (Cl. 3K3)
Air pressure: 86 kPa to 106 kPa kPa (Class 3K3)
Storage temperature: -25 to +55°C (Class 1K4)
Transportation temperature: -25 to +70°C (Class 2K3)
Immunity to vibrations: 3.0 mm from 5 to 9 Hz, 1 g from 9 to 200 Hz (Class 3M4)
Immunity to shocks: 10 g, half-sine, 6 ms (Class 3M4)

IDBS W120/240
Min water flow rate: 2.5 l/min @ 20°C or 3.5 l/min @ 25°C
Max water pressure 10^5 Pa (1 bar)

Model	Output Current			Weight
	Nominal	Max		
	Arms	Arms	Apeak	(kg)
IDBS - 3/9	3	6.5	9	10
IDBS - 6/15	6	10.5	15	10
IDBS - 8/22	8	15.5	22	10
IDBS - 15/42	15	30	42	12
IDBS - 25/70	25	50	70	13
IDBS - 35/90	35	64	90	14
IDBS - 50/140	50	100	140	22
IDBS - 60/180*	60	127	180	23
IDBS - 100/240*	100	170	240	46
IDBS - W120/240*	120	170	240	50
IDBS - 100/320*	100	226	320	46
IDBS - 180/320*	180	226	320	56

* = 5 kHz switching frequency

1.6 INTERFACES

1.6.1 ANALOG

- One Analog differential input 0 +10V
- One Single ended input
- One tacho signal (programmable)
- resolver signal interface
- output current signal (programmable)

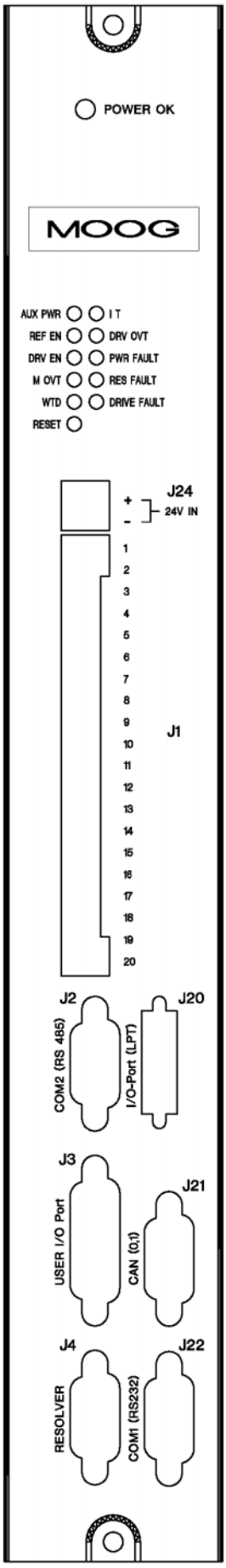
1.6.2 DIGITAL

- RS 232 serial link
- RS 485 serial link
- CanOpen Interface
- Simulated encoder output
- Programmable LPT1 port

1.6.3 ON/OFF (opto isolated)

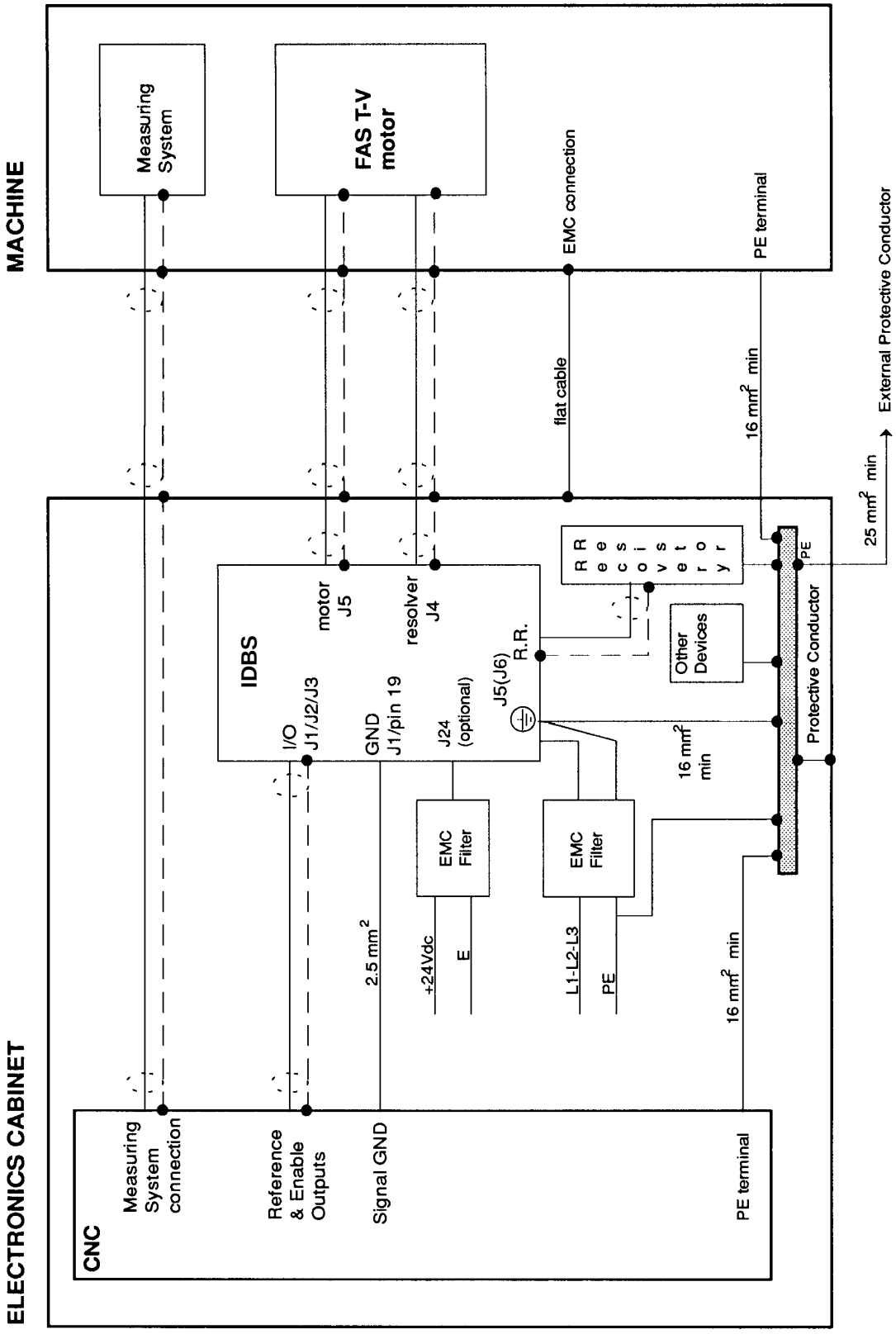
- drive OK
- motor OK
- drive enable
- motor enable

FIG.1.6 IDBS Common Control Panel



1.7 SYSTEM GROUNDING

FIG. 1.7 EMC/Equipotential Bonding



1.8 RATING PLATE

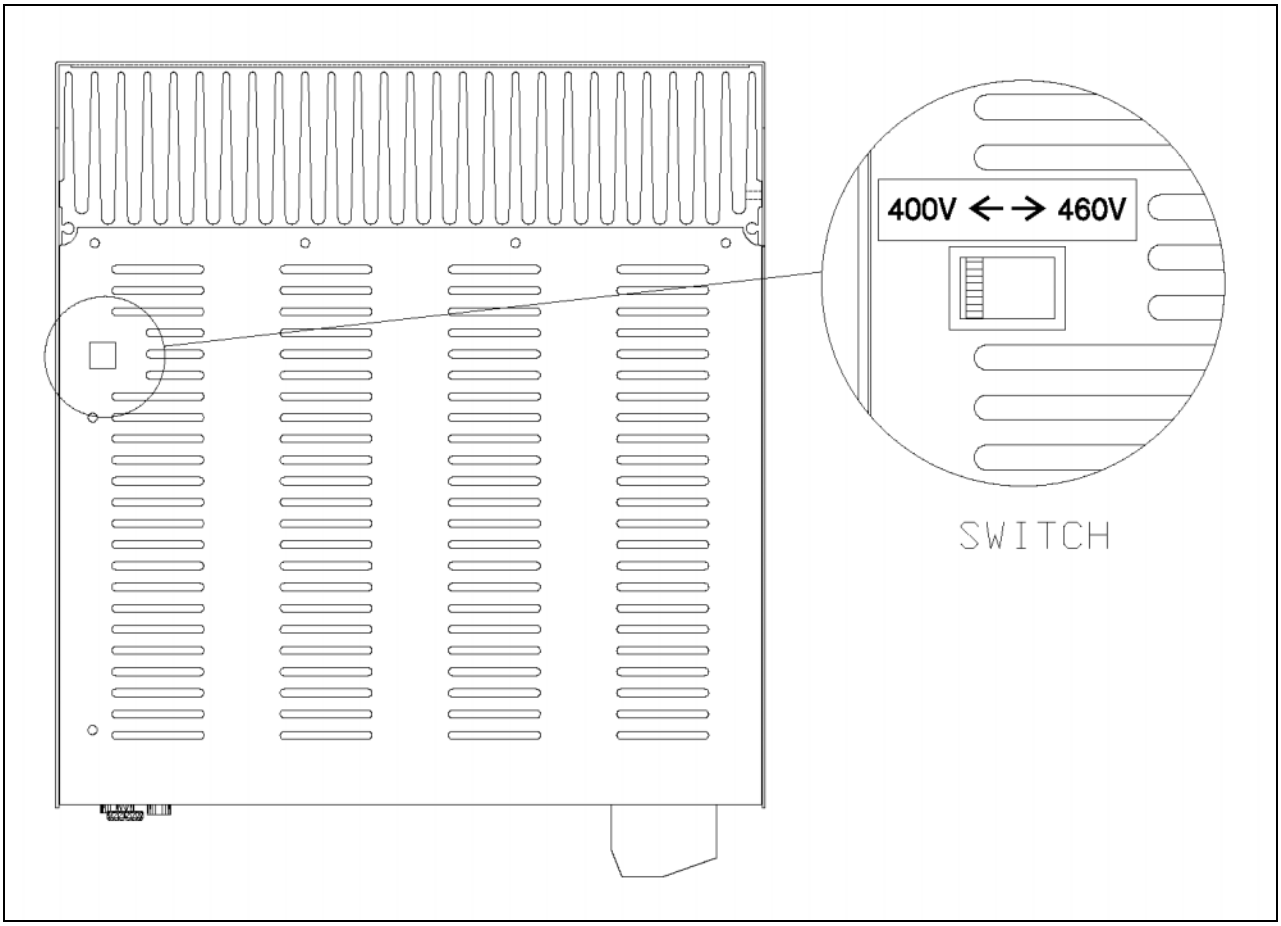
The following informations are supplied on the rating plate of IDBS.

CODE: CNxxxxxx	model code
S/N: AASSNNNNYY	serial number, where AA=year, SS=week, NNNN=progressive number, YY=option code (00=standard, 02=resolver interface)
Vin: xxx V	nominal three phase input voltage
3-phase 50/60 Hz	
Iin: xxx A_{rms}	nominal rms input current
Iout nom: xxx A_{rms}	nominal rms output current
Iout max: xxx A_{peak}	peak output current
BBB $C_1C_2C_3$-C_4	BBB=Channels of the optional RIC (SRC=Single-channel Restart interlock Circuit, DRC=Dual-channel Restart interlock Circuit). May not be typed. C_1=pulses per electrical revolution (C=64, D=128, E=256, F=512, G=1024, H=2048, I=4096, L=8192, M=16384) C_2=motor poles (A=2, B=4, C=6, D=8, E=10, F=12) C_3=resolver poles (A=2, B=4, C=6, D=8, E=10, F=12) C_4 =marker width (A=1, B=1/2, C=1/4, D=no marker)

2. INSTALLATION

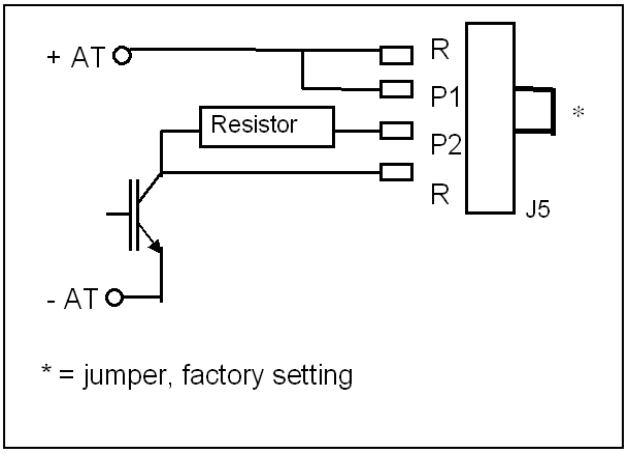
***CAUTION**: make sure that the correct input voltage has been set on the top panel*

Fig. 2.1 - 400/460V Setting



***CAUTION**: make sure that the correct wiring for IDBS 3/9, 6/15, 8/22, 15/42 has been set for recovery resistance on J5 connector:*
- check the jumper between P1 and P2 to use the internal recovery resisto (standard braking)
or
- disconnect the jumper and connect an external recovery resistance to RR pins (hard braking)

Fig. 2.2 - P1/P2 Jumper



2.1 FUSES

2.1.1 INTERNAL FUSES

IDBS drive has the following fuses on the bus bars:

- IDBS 3/9, IDBS 6/15, IDBS 8/22: 50A ultrafast (cod. AM6408)

2.1.2 EXTERNAL FUSES

***CAUTION** : equipment suitable for use on a circuit capable of delivering not more than 5000 RMS symmetrical Amperes, 460V +10% maximum, when protected by semiconductor type fuses, manufactured by Bussmann Div.Cooper (UK) Ltd, mod.No. per the following table, according to UL508C (1998)*

	IDBS Model					
	15/42	**25/70, 35/90**	**50/140, 60/180**	**100/240**	**W120/240**	**100/320 180/320**
Input power line fuse	Type 50-FE (50A/660Vac)	Type 100-FEE (100A/660Vac)	Type 160-FEE (160A/660Vac)	Type 280-FM (280A/660Vac)	Type 315-FM (315A/660Vac)	Type 500-FMM (500A/660Vac)

2.2 SOFT-START

The soft start is included in the circuit. The soft start resistors are short-circuited after 250ms.

2.3 FANS

***CAUTION**: a free circulation must be guaranteed for the air flow.*

2.3.1 IDBS 3/9 to 60/180 - FANS

The ventilation is provided by fans mounted under the modules.
The input power is provided with an external DC 24 Volt connector for standard IDBS models.

2.3.2 IDBS 100/240, 100/320, 180/320 - FANS

The ventilation is provided by three 24 Vdc fans for IDBS 100/240, 100/320 and five 24 Vdc fans for IDBS 180/320, mounted under the modules.
They must be powered by the user in the 24 Vdc input connector.
Total power rating is 33 W for IDBS 100/240, 100/320 and 55 W for IDBS 180/320.

2.3.3 IDBS W120/240 - FANS

The card ventilation is provided by one fan mounted under the drive.
The other four fans under the drive are anti-condensation devices and must be powered by the user, via 24 Vdc, 12 W inputs on J6 connector, 5 minutes before start-up. After start-up these fans can be powered off.

***CAUTION**: the anti-condensation fans of the IDBS W120/240 must be powered on 5 min. before start up*

2.4 LED'S

Tab. 2.1 - Module - Led's

Name	Function
Red LED DRIVE FAULT	generic fault: the fault can correspond, according to the type, to a LED on the front end; if other red LED's are not on, out of the considered one, it is necessary to interrogate the drive via serial link to know the fault reason.
Red LED WTD	Watch dog - signal; microprocessor circuit faults; this LED is on during reset
Red LED RES FAULT	Resolver fault - signal; resolver fault, sin /cos signals interrupted, short circuit between signals or 10kHz carrier abnormal
Red LED M OVT	Motor overtemperature
Red LED DRV OVT	Module overtemperature
Red LED PWR FAULT	Intelligent Power Module fault
Green LED REF.EN	Input enable
Green LED DRV EN	Axis enable
Red LED IT	IT protection
Green LED AUX PWR	Auxiliary power OK

2.5 RESET BUTTON

Tab. 2.2 – Reset Button

RESET BUTTON	Digital control card reinitialization and reset of some protections

2.6 WIRING

2.6.1 SIZING OF WIRES

It is recommended to use Cu, stranded and/or solid wires, 75°C (167°F), UL approved, per the following table.
Note that this sizing of wires is referred to new (UL) version of connectors.

Tab. 2.3A - Sizing of Wires

	IDBS Model						Notes
	3/9 to 8/22	**15/42**	**25/70 35/90**	**50/140 60/180**	**100/240 100/320 W120/240**	**180/320**	
Line Power wiring (No.of wires x AWG)	4 x 14 AWG	4 x 10 AWG	4 x 8 AWG	4 x 4 AWG	4 x 1/0 AWG	4 x 4/0 AWG	
Motor Power wiring (No.of wires x AWG)	4 x 14 AWG	4 x 10 AWG	4 x 8 AWG	4 x 4 AWG	4 x 1/0 AWG	4 x 4/0 AWG	shielded
Recovery Resistor wiring (No.of wires x AWG)	2 x 14 AWG	2 x 10 AWG	2 x 8 AWG	2 x 8 AWG	2 x 8 AWG	2 x 2 AWG	shielded
Optional Dc-Bus (+/-AT) wiring (No.of wires x AWG)	2 x 14 AWG	2 x 10 AWG	2 x 8 AWG	2 x 4 AWG	2 x 1/0 AWG	2 x 2 AWG	shielded
Optional +24V Power Supply wiring (No.of wires x AWG)	2 x 14 AWG						shielded
Resolver wiring (No.of wires x AWG)	4 x 2 x 22 AWG						with 4 pair, each pair twisted and individually shielded with an independ-ent overall shield

Tab. 2.3B - AWG/mm^2 Conversion Table

AWG	22	20	18	16	14	12	10	8	6	4	3	2	1	1/0	4/0
mm^2	0.3	0.5	0.8	1.3	2.1	3.3	5.3	8.4	13	21	27	34	42	54	107

Tab. 2.3C - Tightening torque of Terminal Blocks

	HDFK 4	**HDFK 10**	**HDFK 16**	**HDFK 25**	**HDFK 50**	**HDFK 95**
lb in	5-7	13.2-16	18	35	75	133-177
Nm	0.6-0.8	1.5-1.8	2	4	8	15-20

Tab. 2.3D - Wire stripping length for Terminal Blocks

	HDFK 4	**HDFK 10**	**HDFK 16**	**HDFK 25**	**HDFK 50**	**HDFK 95**
in	0.35	0.43	0.63	0.75	0.95	1.1
mm	9	11	16	19	24	27

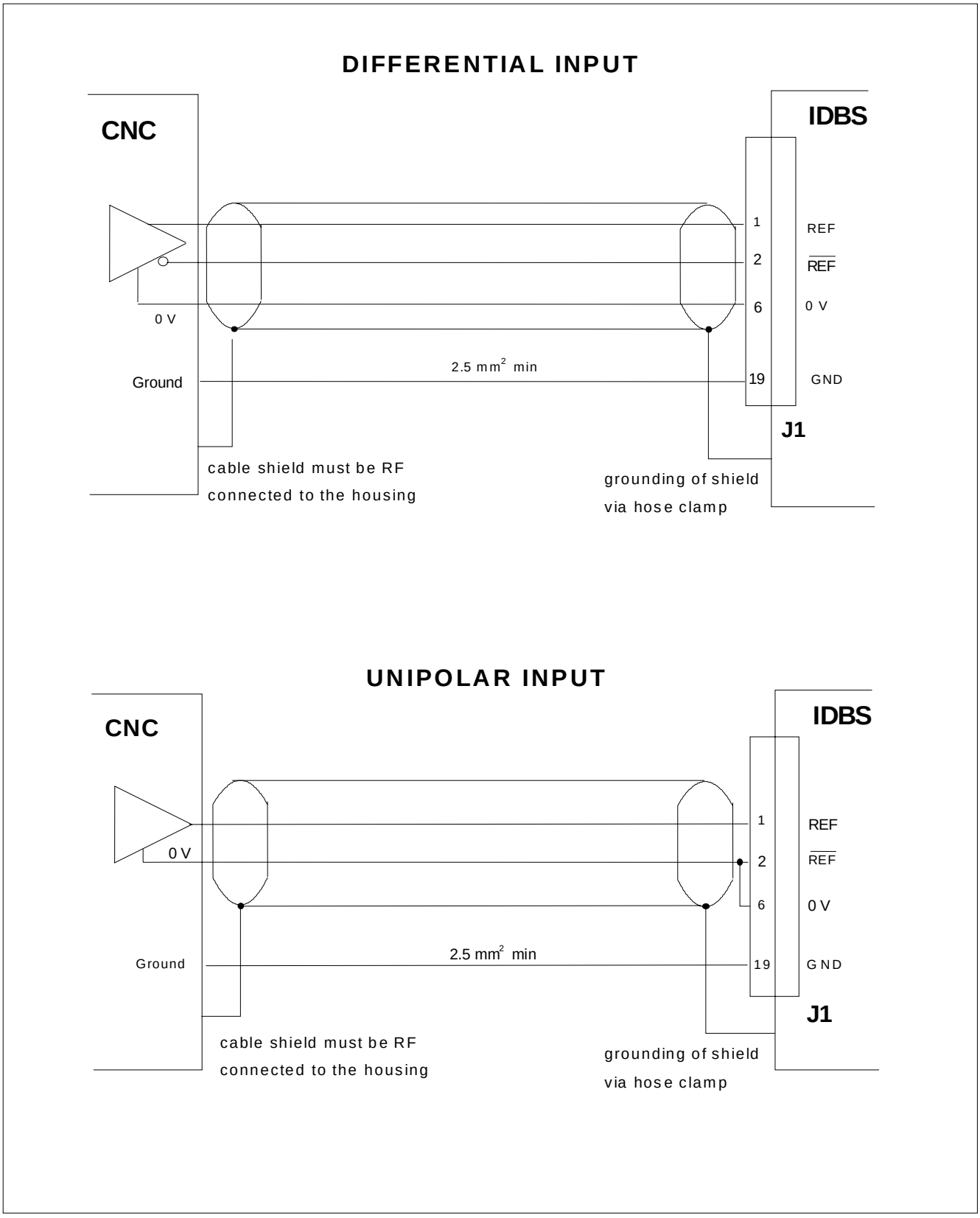
2.6.2 I/O WIRING

All the signal cables must be separated from power cables by a distance ≥30 cm.
See Section 3 for shielding procedures according to EMC Directive.

REMARKs:

- *DRIVE OK (J7 connector): it is suggested to connect the isolated output " DRIVE OK " to a remote control switch so that, if a fault occurs, the power supply is disconnected to avoid system damages.*
- *SIMULATED ENCODER SIGNALS (J7 connector) (if used):*
  - in specially noisy environments it is suggested to connect a 220 ÷ 680 Ω resistor between A and $\overline{A}$, B and $\overline{B}$, C and $\overline{C}$ at the receiver input.
  - for lengths in excess of 5 m (16 ft.) the cable must have 3 pairs, each pair twisted.

Fig. 2.3 – ANALOG INPUT WIRING

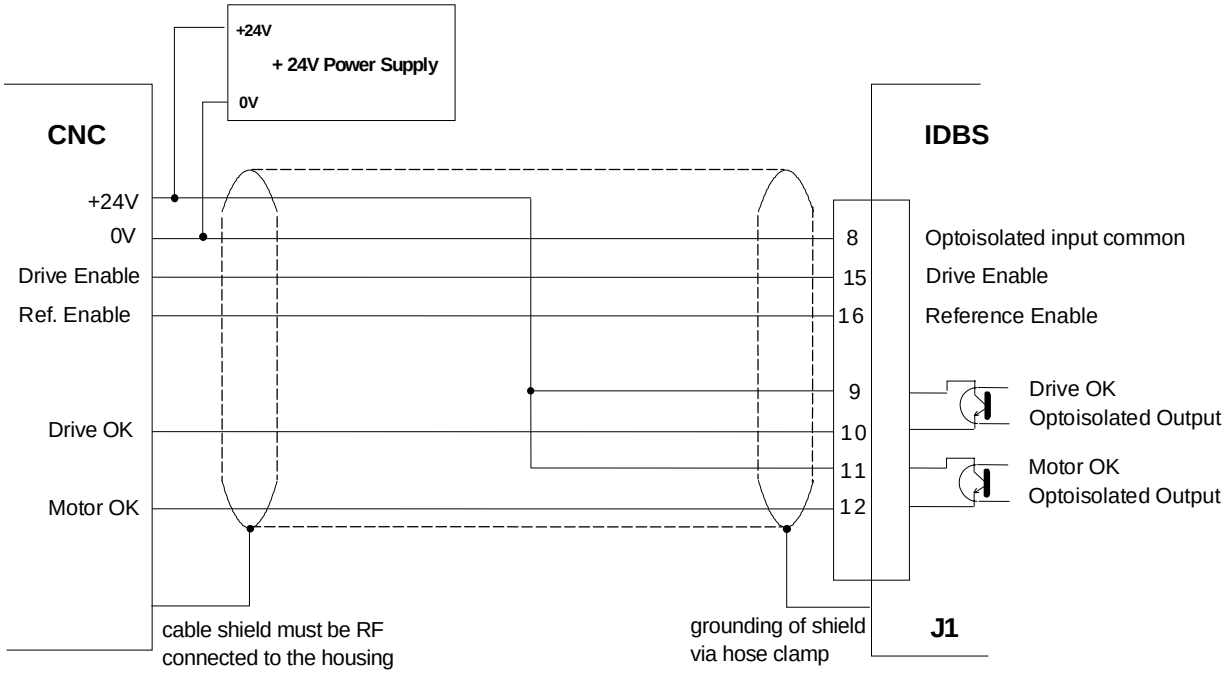


Tab. 2.4 - J1 Connector - I/O Commands And Signals

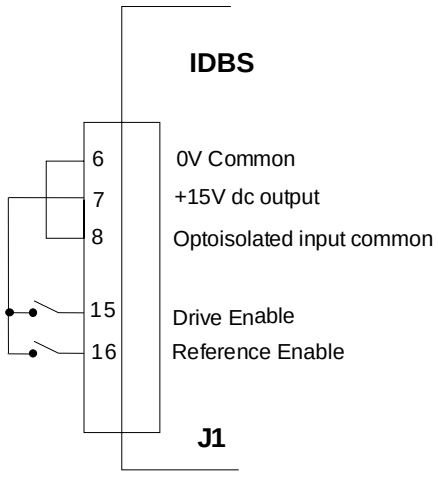
Panel side: male , type Wago 231-450 (code AK5953)
Wiring side: female, type Wago 231-120/026-000 (code AK4960)

Pos.	Name	
1	REF	Differential non-inverting analog input; max range ±10V See Fig. 2.3 for connection
2	___ REF	Differential inverting analog input; max range ±10V See Fig. 2.3 for connection
3	ILIMIT	Analog input (0 to +10V) single ended.
4	TACH0 TEST	Programmable analog output. Full scale ±10V.
5	ANALOG OUT	Analog output for the Iout information, which is the absolute value of the current reference measured on the speed loop output, range ±10V for ± 100% peak current..
6	0V	Analog 0V
7	+15V	+15Vdc output (Imax = 30mA)
8	INP COMMON	Common optoisolated 0V
9	DRIVE OK	Collector of Drive OK optoisolator
10	_____ DRIVE OK	Emitter of Drive OK optoisolator
11	MOTOR OK	Collector of Motor OK optoisolator
12	_____ MOTOR OK	Emitter of Motor OK optoisolator
13	SPARE OUT	Collector of SPARE OUT optoisolator
14	SPARE OUT	Emitter of SPARE OUT optoisolator
15	DRIVE EN	Drive enable optoisolated input, referred to common 0V(J1-8). See Fig. 2.4
16	REF EN	Reference enable: optoisolated input for the confirmation of the reference to the axis (REF EN not active means no speed reference or zero torque), referred to common 0V (J1-8)
17	REMOTE RE-SET	Remote reset: optoisolated input for logic section reset, equivalent to push button on the front panel, referred to common 0V (J1-8). The width of the pulse must be ≥ 200 ms
18	SPARE IN	Spare optoisolated input referred to common 0V(J1-8).
19	0V	Ground. It must be connected to CNC ground with 2.5 mm^2 wire as short as possible.
20	0V	Digital 0V

Fig. 2.4 - Input/Output Wiring



+ 24V POWER SUPPLY



+ 15V INTERNAL SUPPLY
(for drive test)

Tab. 2.5 - J2 Connector - Sub-D 9 pos. - RS485 Port Signal

Panel side: female
Wiring side: male with conductive shell

Pos.	
1	+ Rx (RS485 serial link)
2	N.C.
3	+ Tx (RS485 serial link)
4	N.C.
5	+ 5Vdc output referred to digital 0V
6	- Rx (RS485 serial link)
7	Digital 0V
8	- Tx (RS485 serial link)
9	N.C.

Tab. 2.6 - J3 Connector - Sub-D 15 Pos. - Simulated Encoder Outputs

Panel side: female
Wiring side: male with conductive shell

Pos.	Name	
1	SPARE IN	n.c.
2	/B	encoder output: inverted phase B -
3	A	encoder output: phase A
4	C	encoder output: phase C
5	-15	- 15Vdc output (I max = 30mA)
6	+15	+15Vdc output (I max = 30mA)
7	SPARE IN	n.c.
8	OUT SPARE	n.c.
9	B	encoder output: phase B
10	/A	encoder output: inverted phase A -
11	/C	encoder output: inverted phase C -
12	SPARE IN	n.c.
13	TP1	n.c.
14	TP2	n.c.
15		Digital 0V

Tab. 2.7 - J24 Connector - +24V (Optional)

Panel side: male, type Wago 231-432 (code AK5959)
Wiring side: female, type Wago 231-102/026-000 (code AK4967)

Pos.	Name	
1	+24 IN	Inputs for 24 Vdc (±4V) to retain auxiliary logic supply
2	- 24 IN	Voltage in case of main supply failure (Iload=1.3A; Istdby=0.13A)

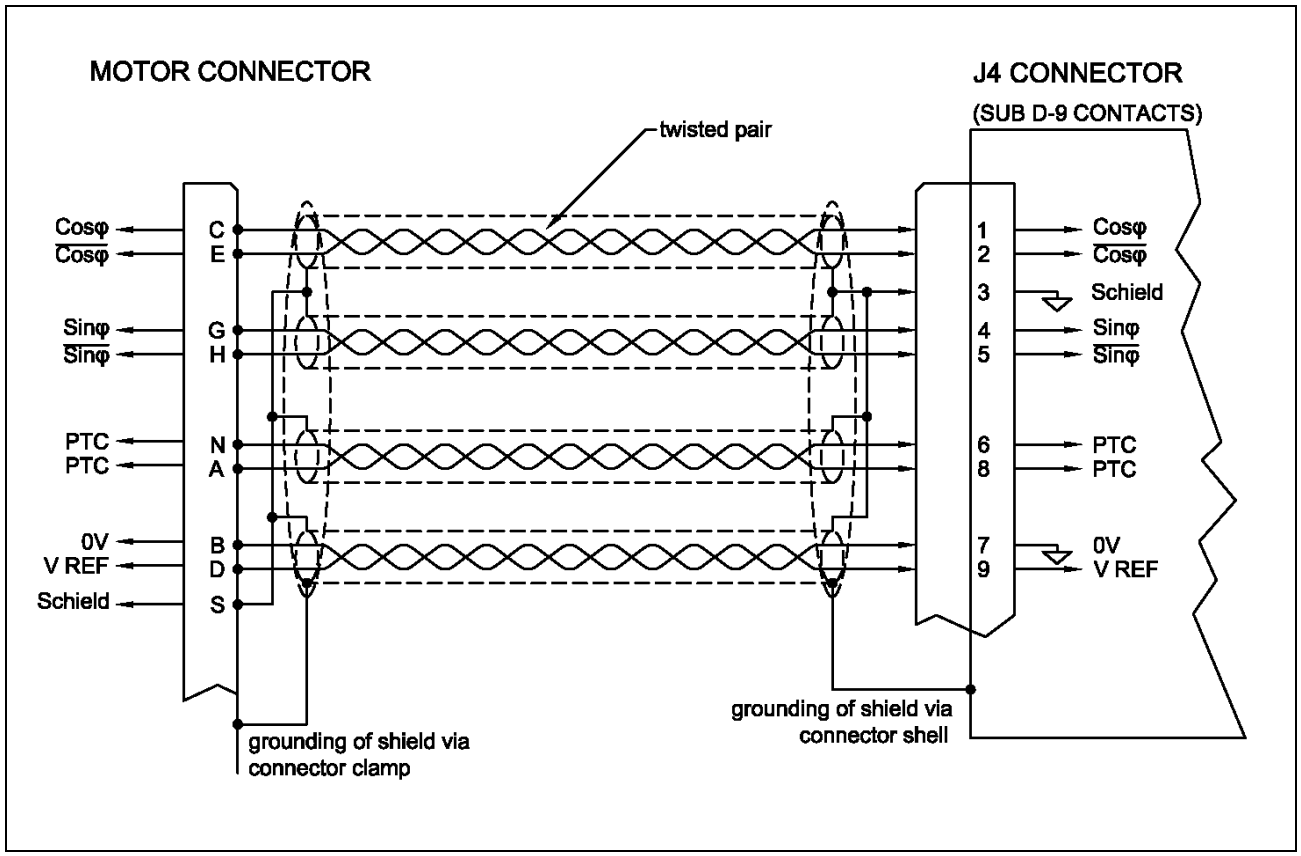
Tab. 2.8 - Input/Output Characteristics

OPTOISOLATED INPUTS Drive enable Reference enable Remote reset Spare In	z in =1.2 kΩ I nom = 10 mA (8 to 20 mA) Vmin = 15Vdc (15 to 25V)
OPTOISOLATED OUTPUTS Drive OK Motor OK Spare Out	z out = 390 Ω I nom = 10 mA (8 to 20 mA) Vnom = 15Vdc (8.5 to 25V)
Analog tacho output	z out = 100 Ω I max = 5 mA Full scale: ± 10V for ± MV
Velocity differential Reference Signals	z in > 20 kΩ Full scale = see MR command Vmax = 12V
Simulated Encoder differential output signals	z out = 100 Ω Full scale = 7V (RS422/RS485 compatible)

Note: For CAN OPEN and RS232 connectors pinout make reference to the Section 5.

2.6.3 RESOLVER WIRING

Fig. 2.5 - Resolver Wiring



RESOLVER CONNECTOR, MOTOR SIDE		
Signal Type	**FAS T / FAS K**	**FAS N**
	Pos.	**Pos.**
cosφ	C	1
$\overline{\cos\varphi}$	E	2
V-Ref	D	10
0V	B	7
PTC	N	8
PTC	A	9
sinφ	G	11
$\overline{\sin\varphi}$	H	12
shield	S	3

Each IDBS must be connected to the resolver via the J4 connector. Figure 2.5 shows the wiring lay-out of the resolver with differential output. We recommend to use 4 pair cables, each pair twisted and individually shielded with an independent overall shield (85% min coverage). 20 AWG (0.60 mm^2) or 22 AWG (0.38 mm^2) wire with low capacitance can be used. We suggest to use ground connections as shown in Fig. 2.5.
Cable length should not exceed 30 m (100 ft.). It is recommended that the signal cable and power cable be separated, if possible, through the use of independent duct (conduit) or by a distance of 12 inches (30 cm).

Tab. 2.9 - J4 Connector - Sub-D 9 pos. – Resolver

Panel side: female
Wiring side: male with conductive shell

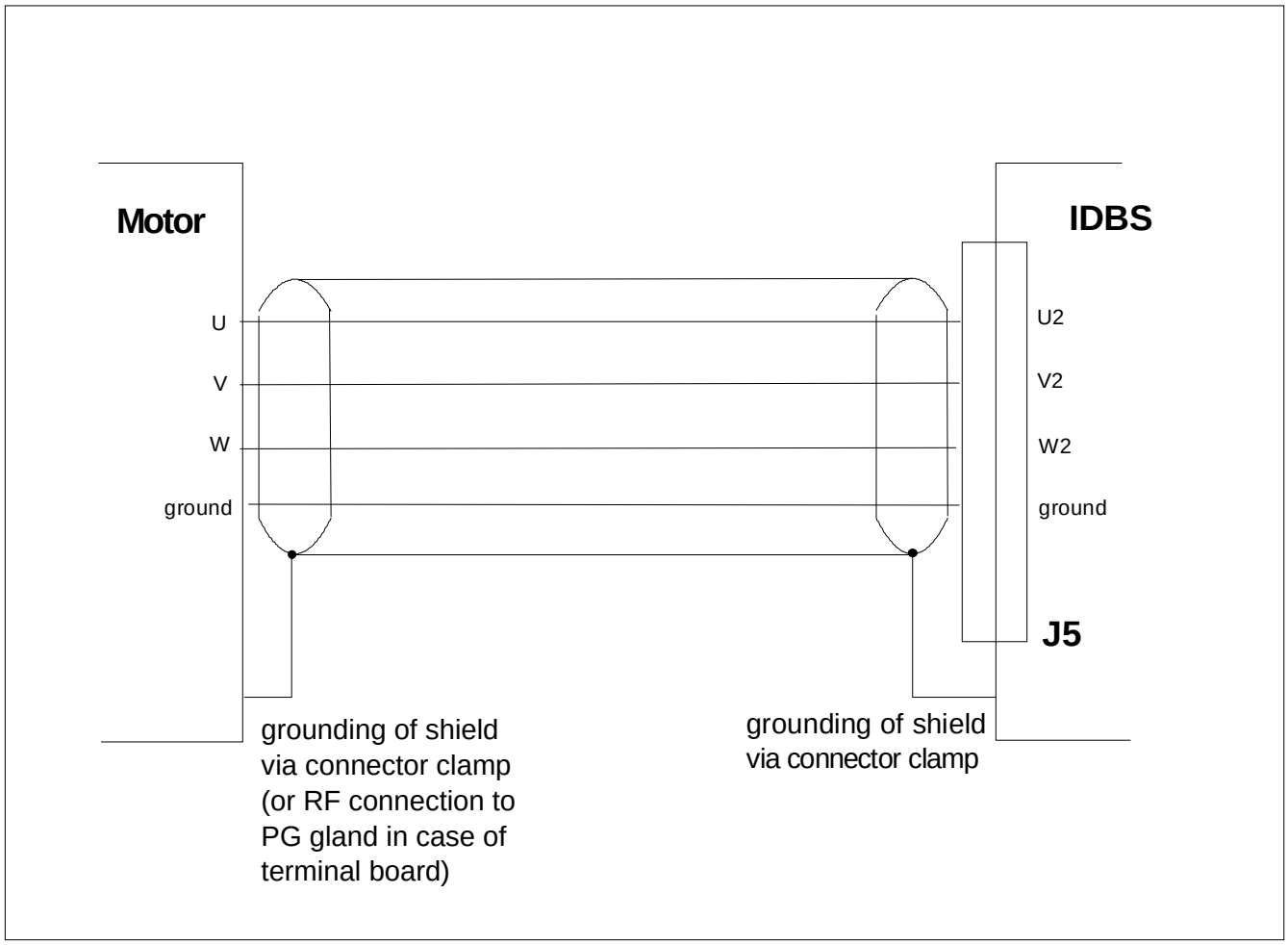
Pos.	Name	
1	cos	Differential cos signal non-inverted input
2	$\overline{\cos}$	Differential cos signal inverted input
3	Shield	Internally connected to 0V common
4	sin	Differential sin signal non-inverted input
5	$\overline{\sin}$	Differential sin signal inverted input
6	PTC	Motor PTC input
7	0V	0V common. Special for 10kHz carrier
8	PTC	Motor PTC input
9	V ref	20 Vpp/ 10kHz sinusoidal output signal for supplying primary resolver winding (carrier)

2.6.4 POWER WIRING

External recovery resistor cable (if applicable) and motor phases cable must be shielded to comply with EMC Directive. Power supply input cable (not shielded) must be connected to the input filter (see Sect.3).See par.2.6.1 for sizing of wires.
It is recommended to use motor phases wiring with low capacitance (max 500 pF/m).

***CAUTION**: do not parallel power connection cables to achieve requested section: this will increase the capacitance value at levels that may irreversibly damage the drive. If the value of capacitance of motor and cables, seen from drive output, exceeds 30 nF it is necessary to verify with Moog technicians the need of an adequate choke in series.*

Fig. 2.6 - Motor Phases Wiring



CAUTION**: the U2-V2-W2 motor phase sequence of the connector at **the drive side** must match the U-V-W motor phase sequence of the connector at **the motor side.

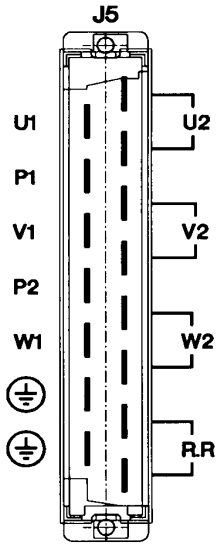
Tab. 2.10 - J5 Power Connector for IDBS 3/9, 6/15, 8/22, 15/42

Panel side: male, type Harting 09.06.015.2912 (code AK5955)
Wiring side: female, type Harting 09.06.215.2871 (code AK4961)

Name	Function
U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
P1	Internal recovery resistance. See P2
V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
P2	Internal recovery resistance. The female connector has a jumper between P1 and P2 (factory setting) which connects a 56Ω/240W internal resistor to +HV. To use an external resistor this jumper must be disconnected. See Fig.2.2
W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
⏚	Protective bonding
⏚	Motor ground
U2*	"U2" phase, three-phase output voltage to motor
V2*	"V2" phase, three-phase output voltage to motor
W2*	"W2" phase, three-phase output voltage to motor
R.R.	External recovery resistor, if applicable. In this case the jumper between P1 and P2 must be disconnected.
R.R.	

* only one wire and one pin per phase shall be used

Fig. 2.7 - J5 Power Connector for IDBS 3/9, 6/15, 8/22, 15/42



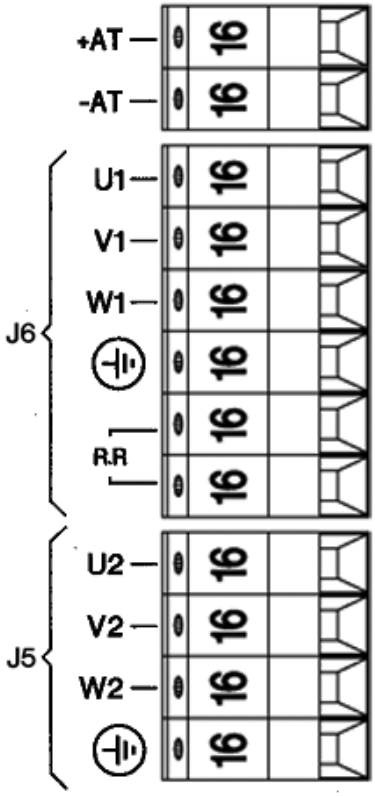
***CAUTION**: the jumper between P1 and P2 must be disconnected before connecting an external recovery resistance on small IDBS drives (see Fig.2.2)*

Tab. 2.11 - J5 and J6 Power Connectors for IDBS 25/70, 35/90, 50/140, 60/180

Terminal blocks type Phoenix HDFK 16 (code AK7427). See also par.2.6.1.

	Terminal Block Type	Name	Function
	HDFK 16	+AT	Output Dc-Bus. This optional output can be used to supply the Dc-Bus of another IDBS drive (e.g. IDBS of same size with a 50% contemporaneity factor)
	HDFK 16	-AT	
J6	HDFK 16	U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 16	V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 16	W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 16	⏚	Protective bonding
	HDFK 16	R.R.	External recovery resistor
	HDFK 16	R.R.	
J5	HDFK 16	U2	"U2" phase, three-phase output voltage to motor
	HDFK 16	V2	"V2" phase, three-phase output voltage to motor
	HDFK 16	W2	"W2" phase, three-phase output voltage to motor
	HDFK 16	⏚	Motor ground

Fig. 2.8 - J5 and J6 Power Connectors for IDBS 25/70, 35/90, 50/140, 60/180

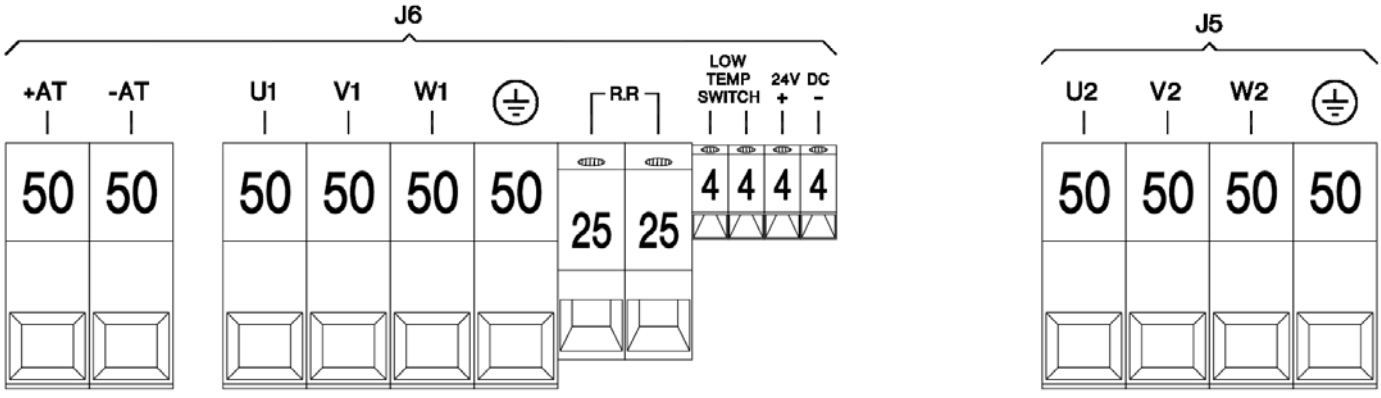


Tab. 2.12 - J5 and J6 Power Connector for IDBS 100/240, 100/320, W120/240

Terminal blocks by Phoenix type HDFK 50 (code AK7428), HDFK 25 (code AK7421), HDFK 4 (code AK7418). See also par.2.6.1.

	Terminal Block Type	Name	Function
J6	HDFK 50	+AT (**)	Output Dc-Bus. This optional output can be used to supply the Dc-Bus of another IDBS drive (e.g. IDBS of same size with a 50% contemporaneity factor)
	HDFK 50	-AT (**)	
	HDFK 50	U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 50	V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 50	W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 50	⏚	Protective bonding
	HDFK 25	R.R.	External recovery resistor
	HDFK 25	R.R.	
	HDFK 4	LOW TEMP SWITCH (*)	Thermal switch. Normally closed contact (max 5A). Rated to open at 40°C ±3°C heatsink temperature. With intermittent water flow, It can be used to start the water pump when the heatsink temperature becomes > 40°C. With continuous water flow, it can be used to check the water temperature (the drive overtemperature protection trips at 71°C).
	HDFK 4		
	HDFK 4	+24 Vdc	IDBS 100/240: 24 Vdc (1 A) input voltage for fans. IDBS W120/240: 24 Vdc (0.6 A) input voltage for the anti-condensation fans. ***CAUTION**: fans must be powered on 5 min. before start up*
	HDFK 4	-24 Vdc	
J5	HDFK 50	U2	"U2" phase, three-phase output voltage to motor
	HDFK 50	V2	"V2" phase, three-phase output voltage to motor
	HDFK 50	W2	"W2" phase, three-phase output voltage to motor
	HDFK 50	⏚	Motor ground

Fig. 2.9 - J5 and J6 Power Connectors for IDBS 100/240, 100/320 , W120/240



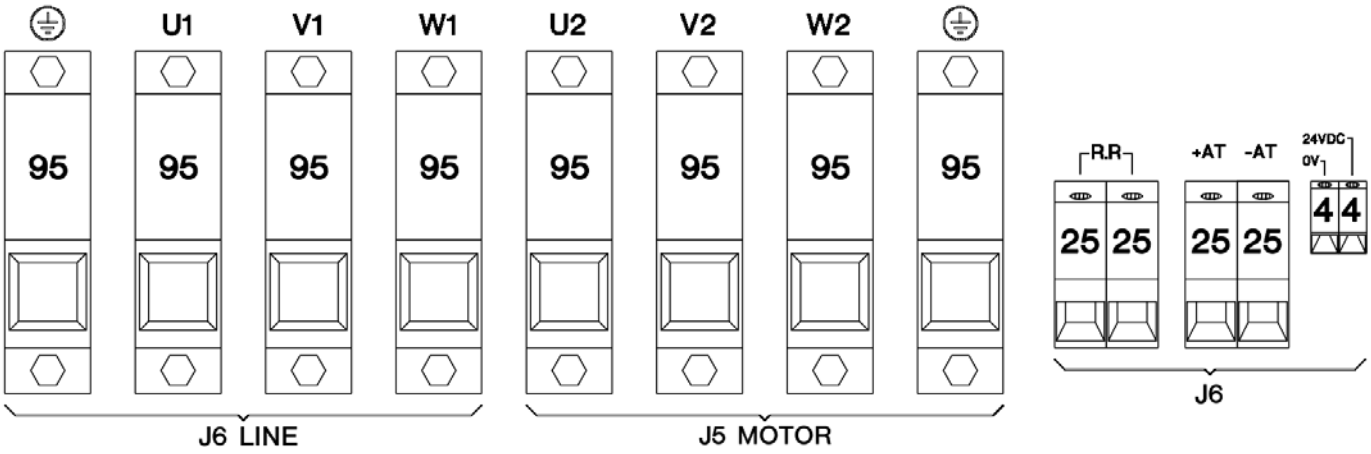
(*) NOTE: the Low Temp.Switch is mounted only on IDBS W120/240
(**) NOTE: the Output Dc-Bus (+AT,-AT) is **not** mounted on IDBS 100/320

Tab. 2.13 - J5 and J6 Power Connectors for IDBS 180/320

Terminal blocks by Phoenix, type HDFK 4 (code AK7418), HDFK 25 (code AK7421), HDFK 95 (code AK7429). See also par.2.6.1.

	Terminal Block Type	Name	Function
J6 LINE	HDFK 95	⏚	Protective bonding
	HDFK 95	U1	"L1" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 95	V1	"L2" phase, three-phase input voltage 400Vac (or 460Vac)
	HDFK 95	W1	"L3" phase, three-phase input voltage 400Vac (or 460Vac)
J5 MOTOR	HDFK 95	U2	"U2" phase, three-phase output voltage to motor
	HDFK 95	V2	"V2" phase, three-phase output voltage to motor
	HDFK 95	W2	"W2" phase, three-phase output voltage to motor
	HDFK 95	⏚	Motor ground
J6	HDFK 25	R.R.	External recovery resistor
	HDFK 25	R.R.	
	HDFK 25	+AT	Output Dc-Bus. This optional output can be used to supply the Dc-Bus of another IDBS drive (max IDBS 60/180)
	HDFK 25	-AT	
	HDFK 4	0V	24 Vdc/ 55 W input to supply the fans
	HDFK 4	24VDC	

Fig. 2.10 - J5 and J6 Power Connectors for IDBS 180/320



2.7 RECOVERY CIRCUIT

The recovery circuit is formed by a switching regulator, a recovery transistor and a recovery resistance. While braking the motor returns energy which cannot be sent to the line since the rectifier circuit is not regenerative. Returned energy tends to increase the Dc-Bus voltage. When HV reaches 680V (790V for 460 Vac) the switching regulator brings the recovery transistor into conduction, thus connecting the recovery resistance in parallel with filter capacitors. The recovery resistance is formed by enameled wire fixed resistor(s). If the recovery resistance works for intervals shorter than the time necessary to reach thermal equilibrium, the resistor can temporarily handle power levels up to 10 times the nominal power rating of the resistor (short time overload).
If not specifically requested, systems are provided with:

IDBS 3/9, IDBS 6/15, IDBS 8/22: 56Ω, 250W (internal)
IDBS 15/42: 47 Ω, 250W (internal)
IDBS 25/70 and IDBS 35/90: 12Ω, 370W (external)
IDBS 50/140 and IDBS 60/180 with mains at 400V: 8.2 Ω, 750W (external)
IDBS 50/140 and IDBS 60/180 with mains at 460V: 10 Ω, 750W (external)
IDBS 100/240, W120/240, 100/320 , 180/320: 3.9Ω, 1000W (external)

For UL purposes, the following recovery resistors have been tested. The UL mark on the drive covers applications up to these ratings.

IDBS 25/70 and IDBS 35/90: 12Ω, 750W, 1.6% duty cycle
IDBS 50/140 and IDBS 60/180: 8.2 Ω, 2000W, 2.9 % duty cycle
IDBS 100/240, W120/240, 100/320 , 180/320: 3.9Ω, 3000W, 2.1 % duty cycle

***WARNING**: do not touch recovery resistor during operation to avoid scalds.*
***WARNING**: High Voltage - The recovery resistor is connected to the internal Dc-Bus and can reach a value of 810 Vdc*
***CAUTION**: **IDBS 3/9, IDBS 6/15, IDBS 8/22 and IDBS 15/42** have internal recovery resistor. To disable the internal resistor and connect an external resistor it is necessary to disconnect the jumper between P1 and P2 on J5.*
***CAUTION**: an unusual application with motor driven by the load, a large portion of the time, could result in overheating of the recovery resistor.*
If the application requires frequent decelerations, with high inertia, starting from high speed and in short times, it may be necessary to use a non standard external recovery resistor. It is suggested contacting our Customer Service.
***CAUTION**: the recovery resistor cable provided in kit is only for test purposes. It must be shielded to comply with the EMC Directive (89/336/EEC)*
***CAUTION:** for UL approval in the end-use installation, the Dynamic Brake Unit Recovery Resistor, when external, shall have the connection wiring made with R/C (AVLV2) or insulated with R/C (YDPU2) or R/C (UZCW2)*

2.8 STARTING SEQUENCE

- Check the correct setting of the switch 400V/460V on the top of the drive
- Switch on 400 Vac (or 460Vac) three phase power supply
- Wait for Drive OK optoisolated output
- Check if systems parameters and application data are OK for the application

***WARNING**: High Voltage - Discharge Time Approx. 6 Minutes.*
***CAUTION:** in case of repetitive switching off and on, wait 1 minute between off and on.*

2.8.1 AUTOPHASING

• Check that the motor is free to rotate in both directions.
• Check that no fault condition occurs (red drive-fault leds off).
• Check that the analog drive enable is on via positive logic and digital drive enable off.

2.8.2 WIRING CHECK

Axis being phased it is possible to check the wiring by rotating the motor with no load via its digital reference.

• Set KI=2 and KP=5 to avoid motor vibrations.
• Set DF=0 (digital filter disabled).
• Enable analog drive-enable and reference-enable via positive logic.
• Send the ON command (to enable digital drive-enable) using the CAN interface and send Velocity commands to the motor.

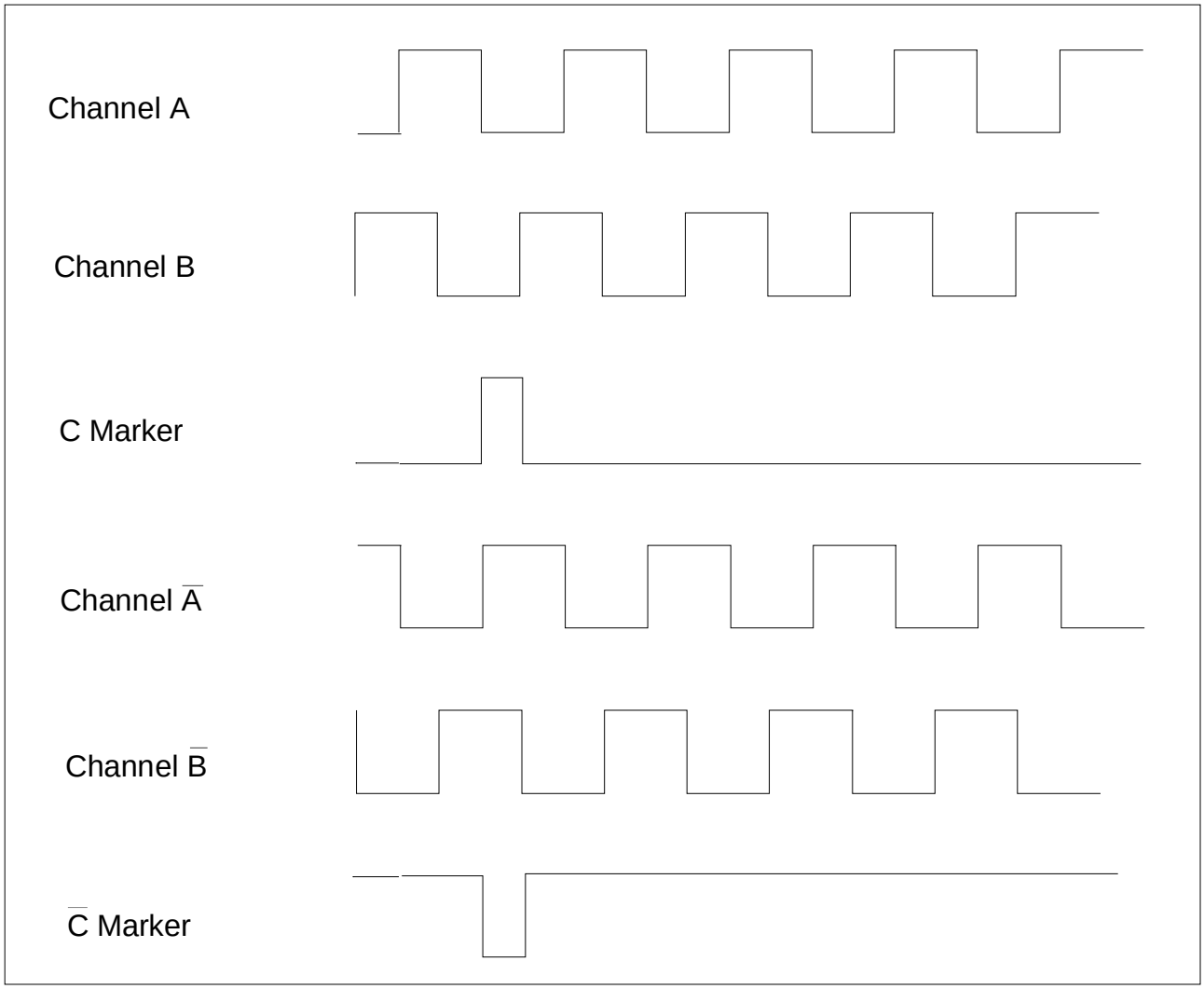
2.9 RESOLVER TO ENCODER OPTION

For position sensing a resolver to encoder option (simulated encoder) is available.
Encoder signals are 7V, 100 Ω impedance, as follows:

- 2 channels of square wave output with a resolution from 64 to 16384 pulses per electrical revolution. Channel B leads channel A by 90° for clockwise rotation when viewed from shaft end.
- 1 marker pulse per electrical revolution (i.e. 1∗ 3 = 3 marker pulses per mechanical revolution with a 6 pole resolver).
- . complementary outputs $\overline{A}$, $\overline{B}$ and $\overline{C}$.

The simulated encoder resolution can be modified with proper command
(see section 5).

Fig. 2.11 - Simulated Encoder (CW Rotation When Viewed From Shaft End)



Note: *to make C marker high when Channel A and Channel B are high (like Siemens), exchange Channel A with Channel $\overline{A}$ and Channel B with Channel $\overline{B}$.*

2.10 MECHANICAL BRAKE

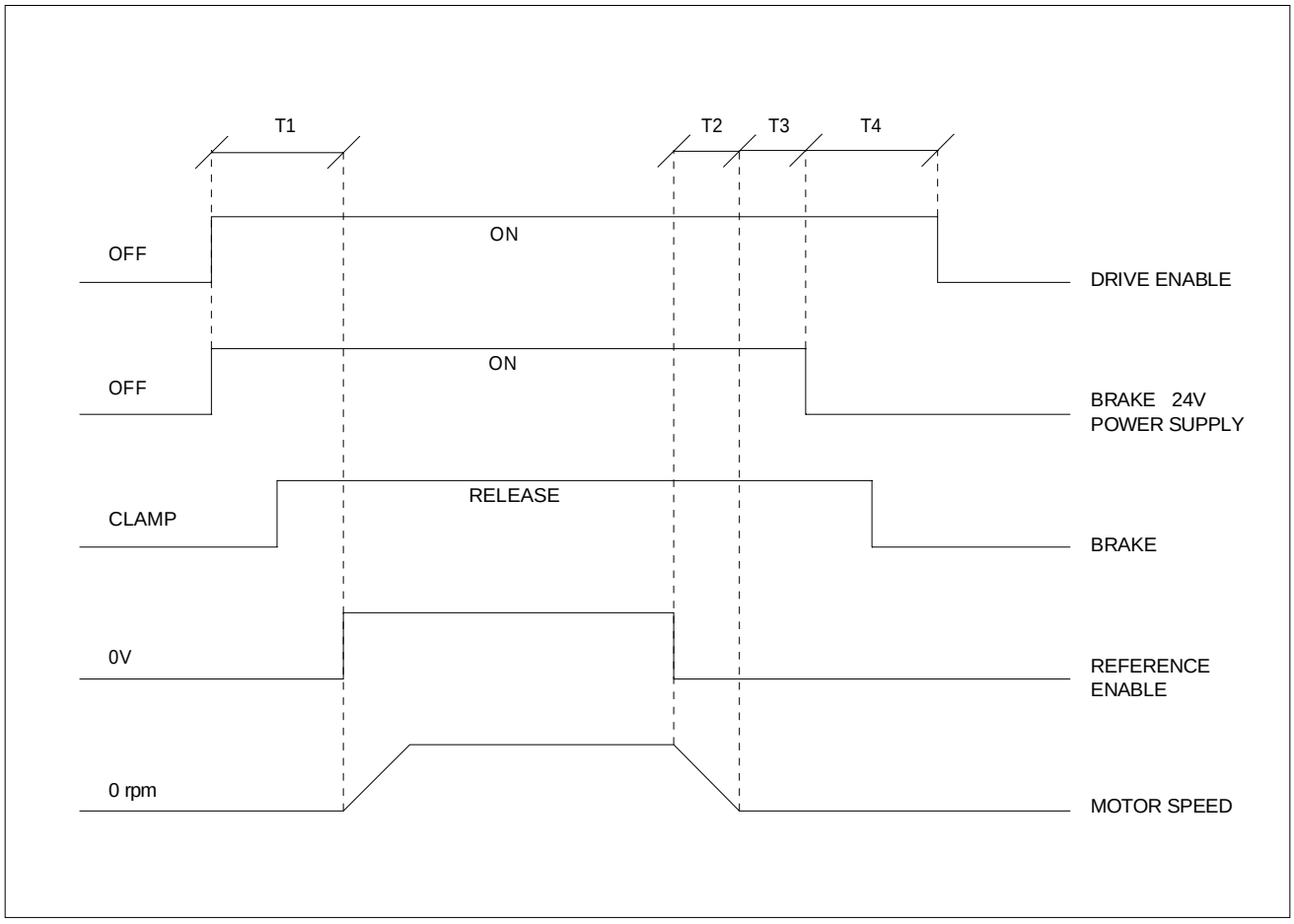
FASTACT servomotors have as option a 24 Vdc (24 to 26 Vdc) electromagnetic safety brake.

***CAUTION**: safety brake must be clamped and released with motor at standstill. Dynamic brakes can seriously damage the brake and reduce the braking torque.*

The release of the brake (from 0V to +24V) and the clamp (from +24V to 0V) must follow the sequence in Fig. 2.12.

FIG. 2.12 - Braking Sequence, Timing Chart

***Note 1**: T1 ≥ 300 ms, T2 = application dependent, T3 = 100 ms, T4 ≥ 200 ms*
***Note 2**: for FASTACT size 3 and size 4 T1 ≥ 1000 ms*



***Note:** as the motor could have different brake models, please make the reference for the right timimg and supply to the motors catalogue too.*

2.11 - SIZING OF POWER SUPPLY CIRCUIT

2.11.1 SIZING OF POWER TRANSFORMER

IDBS drive is designed to allow direct operation from a 400/460 Vac 50/60 Hz 3-phase source. An isolation transformer may still be required to meet local electrical safety regulations. It is the user responsibility to determine if an isolation transformer is required to meet these requirements. To size the transformer it is necessary:

- to refer to the rated output power of the motors (the output power with 65K winding overtemperature is included in the Technical Data table of catalogs of servomotors)
- to sum the power of single axes and to multiply the sum by the contemporaneity factor (factors often utilized are K_c=0.63 for 2 axes, K_c=0.5 for 3 axes, K_c=0.38 for 4 axes, K_c=0.33 for 5 axes, K_c=0.28 for 6 axes) in case of multi-axis application
- to multiply by a correction coefficient (=1.2), accounting for the losses of the motor/drive system.

$P = \Sigma P_{im} * K_c * 1.2$ [W]

2.11.2 AUXILIARY POWER

For a correct sizing, especially for small drives, auxiliary power (30 W for each module) and fan power P_{fan} (7 W for IDBS 3-6-8-15-25-35 and 15W for IDBS 50-60) must be added.

$P_{aux} = 30 + P_{fan}$ [W]

2.12 - POWER DISSIPATION

To calculate cabinet cooling requirements, table below provides estimated equipment power dissipation values. If the application employs continuous braking, it is necessary to include the recovery resistor power dissipation (use the nominal power of recovery resistor if actual application recovery dissipation is unknown).

	IDBS Model									
	3/9	**6/15**	**8/22**	**15/42**	**25/70**	**35/90**	**50/140**	**60/180**	**100/240 100/320**	**180/320**
Power Dissipation	100 W	150 W	190 W	310 W	475 W	650 W	900 W	1100 W	1600 W	2700 W

3. ELECTROMAGNETIC COMPATIBILITY (EMC)

3.1 EUROPEAN DIRECTIVE (89/336/EEC)

Compliance with the European Directive 89/336/EEC is required for all electric and electronic products brought onto the European market after December 31st, 1995.
IDBS drives with FASTACT motors meet the following EMC product standard related to the Directive:

EN 61800-3 (1996) and EN 61800-3/A11 (2000): "Adjustable speed electrical power drive systems. Part 3: EMC product standard including specific test methods".
Second environment (industrial) compatibility levels.

Remark: equipments not intended to be used on a low-voltage public network which supplies domestic premises. May cause radio frequency interference.

Tests have been made in an independent, competent body, test house.

The installer of the drive is responsible for ensuring compliance with the EMC regulations that apply where the drive is to be used. We recommend filtering as per par.3.2 and wiring, grounding and screening as per par.3.3 and 3.4.

3.2 FILTERING

3.2.1 FILTER TYPES

The following filters are recommended.

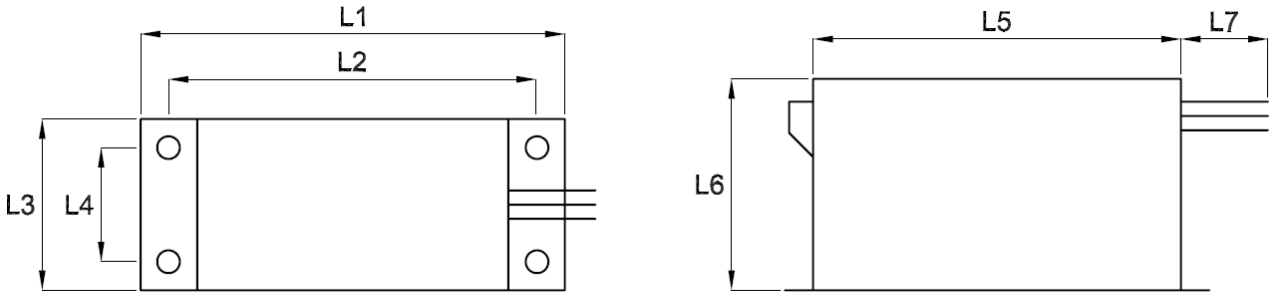
Code	Trade-mark	Rated Current [A] at 50°C (40°C)	Max Voltage [Vac] at 50°C	Drive type
AT6017	Schaffner FN 2070-3-06	(3)	250	IDBS with optional 24Vdc input
AT6009	Schaffner FN 258-7/07	7 (8.4)	3 x 480	IDBS 3/9, IDBS 6/15, IDBS 8/22
AT6010	Schaffner FN 258-16/07	16 (19.2)	3 x 480	IDBS 15/42
AT6011	Schaffner FN 258-30/07	30 (36)	3 x 480	IDBS 25/70
AT6012	Schaffner FN 258-42/07	42 (50.4)	3 x 480	IDBS 35/90, IDBS 50/140
AT6013	Schaffner FN 258-55/07	55 (66)	3 x 480	IDBS 60/180
AT6015	Schaffner FN 258-100/35	100 (120)	3 x 480	IDBS 100/240, IDBS W120/240 IDBS 100/320
	Schaffner FN 258-180/07	180 (216)	3 x 480	IDBS 180/320

3.2.2 FILTER SIZING

The filter/drive coupling in the previous table is a standard coupling.
The filter can be undersized according to the rms input current of the actual application.
This should be done not only because, as a matter of fact, undersizing the filter means less money, but because the undersized filter provides better performance to EMC (make reference to the specific filter attenuation data versus the size).

3.2.3. FILTER DIMENSIONS

Top View **Side View**



Code	Trade-mark	Dimensions [mm]							Weight [kg]
		L1	L2	L3	L4	L5	L6	l7	
AT6017	Schaffner FN 2070-3-06*	85	75	54	0	65	40.3	fast-on terminal	0.25
AT6008	Schaffner FN 250-6/07*	85	75	54	0	65	30	300	0.24
AT6009	Schaffner FN 258-7/07	255	240	50	25	225±0.8	126±0.8	300	1.1
AT6010	Schaffner FN 258-16/07	305	290	55	30	275±0.8	142±0.8	300	1.7
AT6011	Schaffner FN 258-30/07	335	320	60	35	305	150	400	1.8
AT6012	Schaffner FN 258-42/07	329	314	70	45	300	185	500	2.8
AT6013	Schaffner FN 258-55/07	329	314	80	55	300	185	500	3.1
AT6014	Schaffner FN 258-75/34	329	314	80	55	300	220	terminal block	4
AT6015	Schaffner FN 258-100/35	379±1.5	364	90±0.8	65	350±1.2	220±1.5	terminal block	5.5
	Schaffner FN 258-180/07	438±1.5	364	90±0.8	50	350±1.2	220±1.5	terminal block	11

* = the FN2070-3-06 filter have faston at both sides
* = the FN250-6/07 filter have wiring leads (length=300mm) at both sides

3.2.4 FILTER INSTALLATION

- The filter must be mounted on the same drive panel.

CAUTION: *leave a clear space at least 60mm around the filter for air circulation when the cabinet does not have forced ventilation.*

- The filter must be connected as close as possible to the drive input. If the separation between filter and drive exceeds around 30 cm (1 ft.) then a shielded cable should be used for the RF connection between filter and drive.

REMARK: *when mounting the drive and the filter to the panel, it is essential that any paint or other covering material be removed before mounting the drive and the filter.*

The maximum torque of mounting screws (terminal block) is as follows:

FILTER	Max torque
FN 258 - 7/07	0.8 Nm
FN 258 - 16/07	0.8 Nm
FN 258 - 30/07	1.8 Nm
FN 258 - 42/07	1.8 Nm
FN 258 - 55/07	3.0 Nm
FN 258 - 75/34	3.0 Nm
FN 258 - 100/35	4.0 Nm
FN 258 - 180/07	4.0 Nm

NOTE: *The filter can produce high leakage currents (see filter manufacturer Catalogue and filter data)*

NOTE: *if two phases are interrupted, worst case leakage current could dangerous levels*

NOTE: *The capacitors within the filters have discharge resistors.*

CAUTION*: the filter must be connected to ground before connecting the supply*

WARNING*: HIGH VOLTAGE - DISCHARGE TIME APPROX. 10 seconds*

3.3 WIRING AND GROUNDING

All the following cables must be shielded, with 85% minimum shielding coverage:

Power - Power motor cable (see Fig.3.1 and 3.2)
- External recovery resistor cable
- DC-BUS cable

Signal - Simulated encoder cable (if applicable)
- Resolver cable (see Fig.2.5 and 3.2 motor side))
- RS485 cable
- Reference, Enable and OK cable
- 24V power supply cable
- Restart Interlock cable
- 24V fans cable

***NOTE**: Connectors at motor side can have a threaded clamp. Cable shield must be grounded in the same way as in Fig.3.2*

***CAUTION**: the unshielded cable provided with the drive is only for test purposes and not EMC compliant.*

Fig. 3.1 - Grounding Of Shield Without Connector

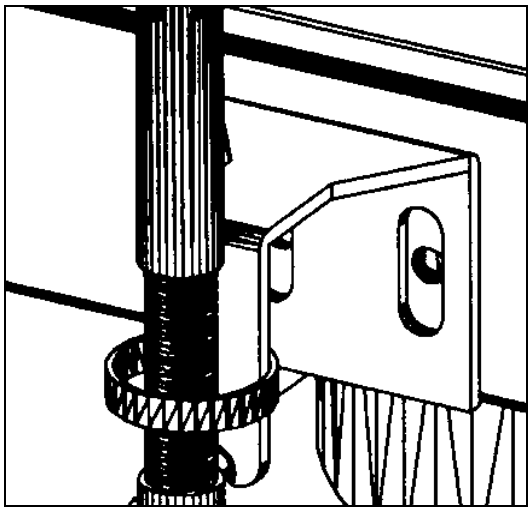
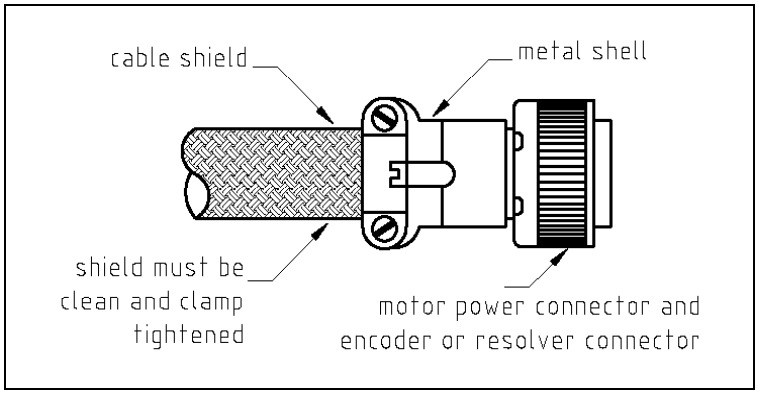


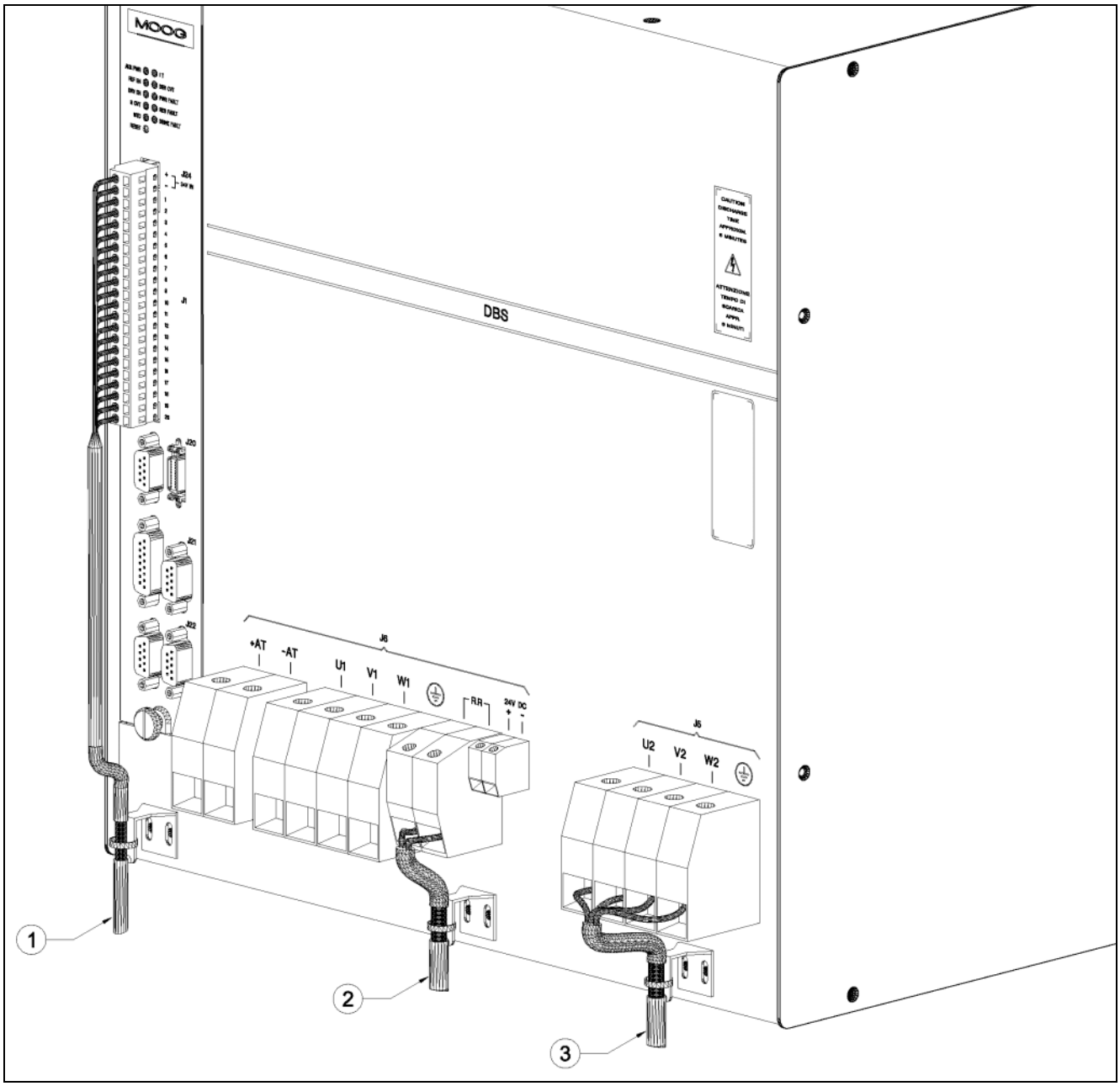
Fig. 3.2 - Grounding Of Shield To Connectors At Motor Side



NOTE: *If a power terminal board is used at motor side, the shield must be RF connected to a metallic PC gland.*

The shields of the cables must be connected at both ends to the proper housing via full circumferential bond to metallic connectors or hose clamps.
In case of Sub-D connector, cable shield must be grounded to the metallic hood.
When there is not metallic connector at drive side, a kit with stand-off, screws and metallic hose clamps is provid.
The shield of the cable must be uncovered from insulation coating and RF connected to the stand-off through the metallic hose clamp, as in Fig.3.1 .

Fig. 3.3 - Grounding At Drive Side



1 = Reference, Enable, OK cable and 24Vdc input (optional)
2 = Recovery resistor cable
3 = Motor power cable

NOTE:Sub-D, Restart Interlock, 24Vdc fans, DC-BUS and unshielded cables not shown

NOTE: *It is not necessary to shield the input power wires.*

REMARKS:

- *the shields of cables inside the cabinet must be 360° clamped to the cabinet wall (see Fig. 3.4).*
- *"noisy" cables must be kept away from "sensitive" cables by at least 30 cm (12 in). Noisy cables include input-power wires, motor power and brake wiring. Sensitive cables include analog or digital signal cables: resolver cable; reference, enable and OK cable; RS485 serial link; simulated encoder wiring.*
- *where noisy cables must cross power cables, this must be done with angles as near to 90° as possible.*
- *The crossing of the cabinet should be accomplished with a low impedance connection between cable shield and enclosure. If a connector is not involved, the shortest practical lengths of connecting strap should be used (see Fig. 3.5).*

FIG. 3.4 - Backpanel Connection

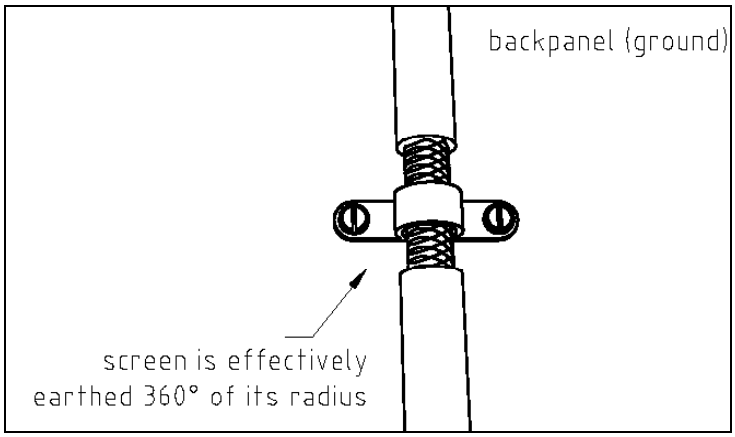
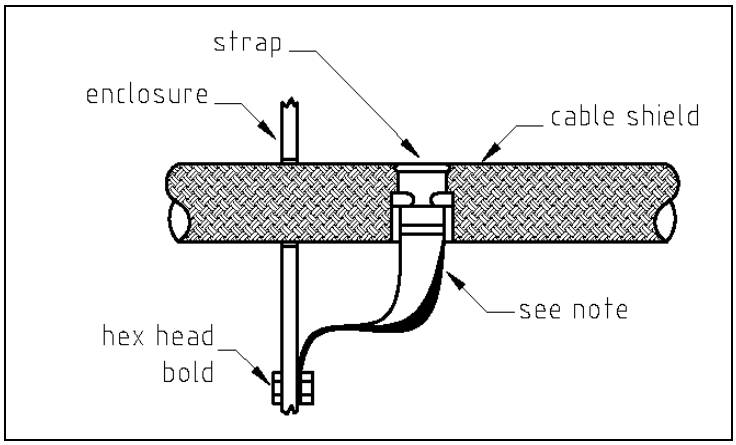


FIG. 3.5 - Partition Penetration



3.4. RECOVERY RESISTOR / MOTOR CHOKE

To meet the EMC Directive, the enclosures containing dynamic braking resistors must be conductive. The cable of recovery resistor must be shielded and the shield must be 360° clamped at both sides.
In some applications (some size 3 FAS T motors) a choke in series for each motor phase has to be added. This choke must be shielded.

REMARK: *when mounting the enclosure of recovery resistor or motor choke to the panel, it is essential that any paint or other covering material be removed before mounting the enclosure of recovery resistor or motor choke.*

3.5 SCREENING

To effectively screening the system all the single screens (CNC, electronic cabinet, machine, motor housing, cables) must be connected together to effectively form one screen (see Fig.1.7).

3.6 SAFETY ASPECTS

Noise suppression of Motor and Drive systems involves consideration of the earthing system, and its effectiveness at high frequencies. It should not be forgotten that is the safety system too and that the safety must take priority over EMC.
To reduce the radiated emissions, the use of capacitance to earth is very effective. In fact IDBS drives have Y-type capacitors near the input power supply connector and Schaffner filters also include them. These capacitors conduct current from phase to earth; this can be in the order of hundreds of milliamperes.

WARNING*: appropriate safety measures should be taken to ensure that this potentially dangerous current flows to earth.*

CAUTION*: it is recommended to disconnect the drive and the EMC filters to carry out the AC Voltage Tests of EN 60204-1 (1997), par.19.4, in order to not damage the Y-type capacitors between phases and ground. Moreover the DC voltage dielectric test required by EN 50178 (1997), product family standard, has been carried out in factory as a routine test. The DC Insulation Resistance Tests of EN 60204-1 (1997), par.19.3, may be carried out without disconnecting the drive and the EMC filters.*

4. PROTECTIONS AND TROUBLESHOOTING

4.1 PROTECTIONS

Protection	Led	Optoisolated Output	RESET
Resolver not ok	DRIVE FAULT RES FAULT	DRIVE OK	Button, Remote Reset,
Auxiliary voltages out of tolerance	DRIVE FAULT	DRIVE OK	Button, Remote Reset,
Motor over temperature	DRIVE FAULT M OVT	DRIVE OK MOTOR OK	Button, Remote Reset,
Power fault	DRIVE FAULT PWR FAULT	DRIVE OK	OFF/ON
Flash Disk Error	DRIVE FAULT	DRIVE OK	Button, Remote Reset,
Bus not normal	DRIVE FAULT	DRIVE OK	Button, Remote Reset,
Drive overtemperature	DRIVE FAULT DRV OVT	DRIVE OK	OFF/ON
Watchdog	DRIVE FAULT WTD	DRIVE OK	Button, Remote Reset,
Overspeed	DRIVE FAULT	DRIVE OK	Button, Remote Reset,

(*) when the IT LED becomes blinking, it indicates the activation of the IT protection; when the IT LED becomes steady illuminated, it indicates the activation of an internal IT protection for IGBT. In this case please ask the Service Centers.

***REMARK:** the reset via Remote Reset can be used only in fault conditions. This reset is carried out by sending a pulse (15V for a time $t \geq 200$ ms) on J1 connector (pos.17).*

4.1.1 RESOLVER NOT OK

Indicated by: DRIVE FAULT LED, RES FAULT (Resolver Fault) LED, optoisolated output DRIVE OK
Set condition: when the resolver is not connected or in short circuit at the power up, when the resolver fails or is disconnected during running.

Effect: the drive inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

4.1.2 AUXILIARY VOLTAGES OUT OF TOLERANCE

Indicated by: DRIVE FAULT LED, optoisolated output DRIVE OK.

Set condition: when the level of +/- 15V or 5V becomes out of tolerance.

Effect: inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

4.1.3 MOTOR OVER TEMPERATURE

Indicated by: DRIVE FAULT LED, M OVT LED, optoisolated outputs DRIVE OK and MOTOR OK

Set condition: when a limit temperature is reached inside the motor.

Effect: the drive inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

Note: *the fault information via LED's and opto is reset when the motor temperature goes down the limit, while the drive is disabled until the reset condition has been met.*

4.1.4 POWER FAULT

Indicated by: DRIVE FAULT LED, PWR FAULT LED, optoisolated output DRIVE OK.

Set conditions:
1. When a short circuit is detected between motor phases, phase and ground, phase and HV.
2. When overcurrent is detected in motor phases.
3. Overheating of power modules (locked rotor condition).
4. Undervoltage of internal supply of power modules

Effect: the drive inhibit torque.

Reset condition: if the condition is not present anymore, power off and on the power supply. In case of condition 3. (overheating) wait at least 3 minutes before power up the drive.

4.1.5 FLASH DISK ERROR

Indicated by: DRIVE FAULT LED, optoisolated output DRIVE OK.

Set condition: when error in writing data into the flash disk is detected..

Effect: inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

4.1.6 BUS NOT NORMAL.

Indicated by: DRIVE FAULT LED, POWER OK LED, optoisolated output DRIVE OK.

Set condition: when the bus bar voltage is over/under than the fixed thresholds (see fig. 4.1 and fig.4.2)

Effect: inhibit torque.

Reset condition: if the condition is not present anymore at analog level (with hysteresis), reset button on drive, send pulse to REMOTE RESET.

FIG. 4.1 Bus Bar Voltage (400V)

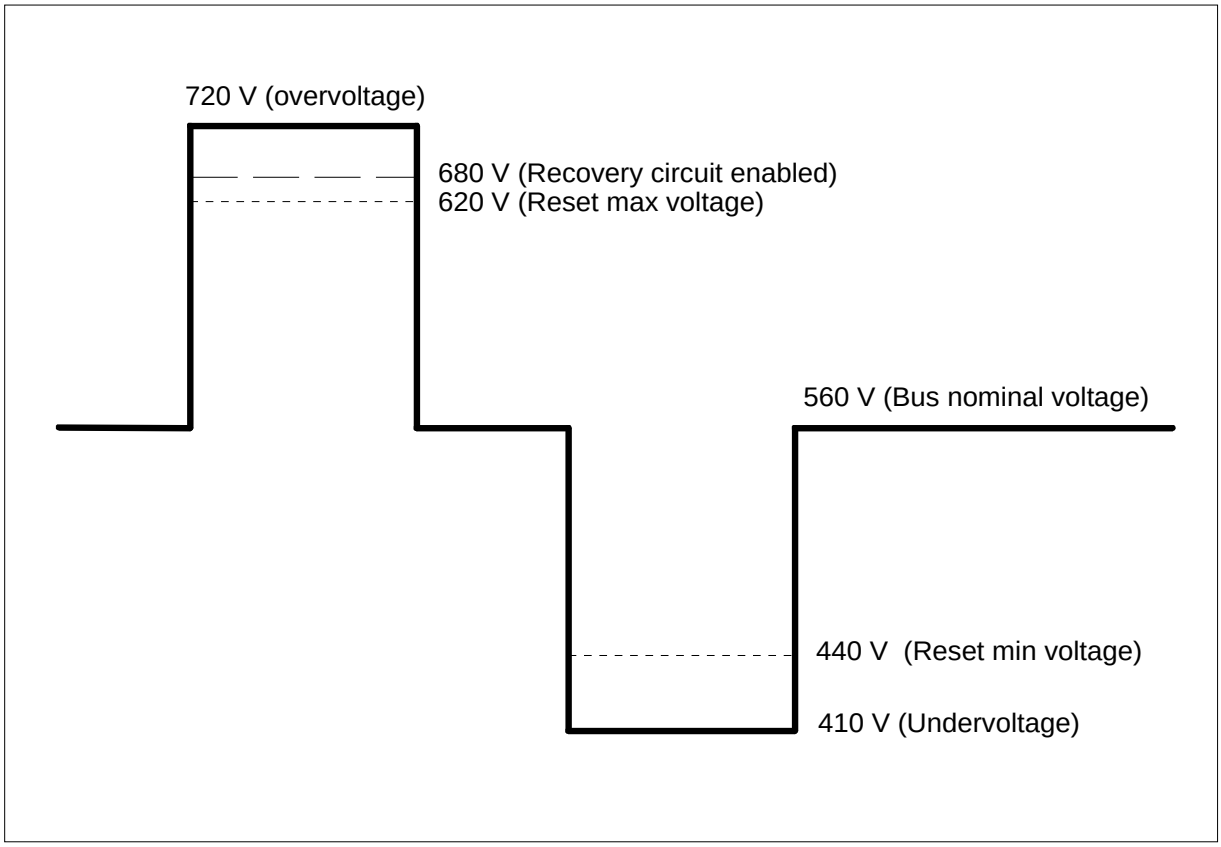
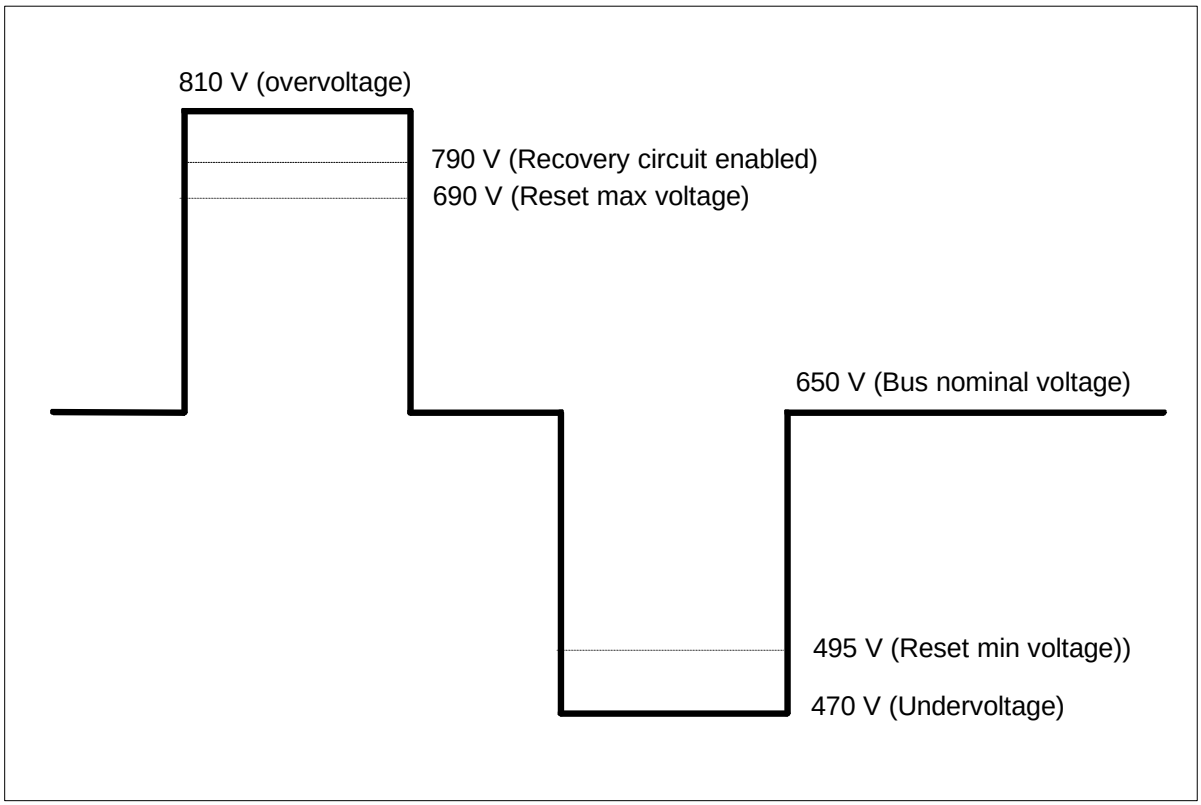


FIG. 4.2 Bus Bar Voltage (460V)



4.1.7 DRIVE OVERTEMPERATURE

Indicated by: DRIVE FAULT LED and DRV OVT LED, optoisolated output DRIVE OK.

Set condition: when a limit temperature is reached on the heatsink.

Effect: inhibit torque.

Reset condition: if the condition is not present anymore, power off and on the power supply.

Notes: the temperature limit is detected by thermo-switch.

4.1.8 IT

Indicated by: IT LED.

Set condition: when the current exceeds the nominal motor current for a time longer than the time stated by the motor thermal model.

Effect: when the fault is going on the current limit is reduced to the level of the motor rated current.

Reset condition: when the set condition is not present anymore. Power OFF and ON the drive to reset the protection.

REMARK: *when the IT LED becomes blinking, it indicates the activation of the IT protection; when the IT LED becomes steady illuminated, it indicates the activation of an internal overload protection. In this case please ask the Service Centers.*

4.1.9 WATCHDOG

Indicated by: DRIVE FAULT LED, WTD LED, optoisolated output DRIVE OK.

Set condition: when the micro controller or DSP fails.

Effect: inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

4.1.10 OVERSPEED

Indicated by: DRIVE FAULT LED, optoisolated output DRIVE OK.

Set condition: when an error between set speed and actual speed bigger than the programmed.

Effect: inhibit torque.

Reset condition: if the condition is not present anymore, reset button on drive, send pulse to REMOTE RESET.

4.2 TROUBLESHOOTING

FIG. 4.3 - POWER OK green LED off

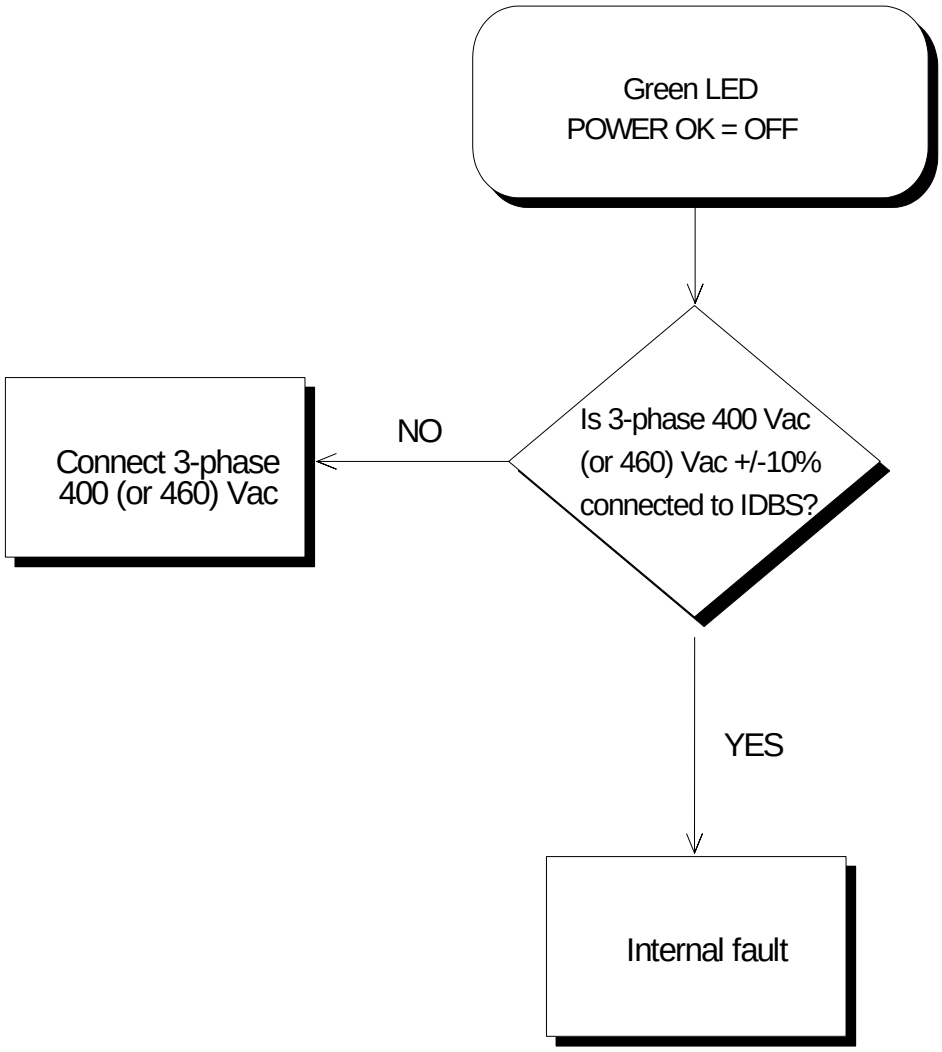


FIG. 4.4 - AUX PWR green LED off
Auxiliary Power Fault

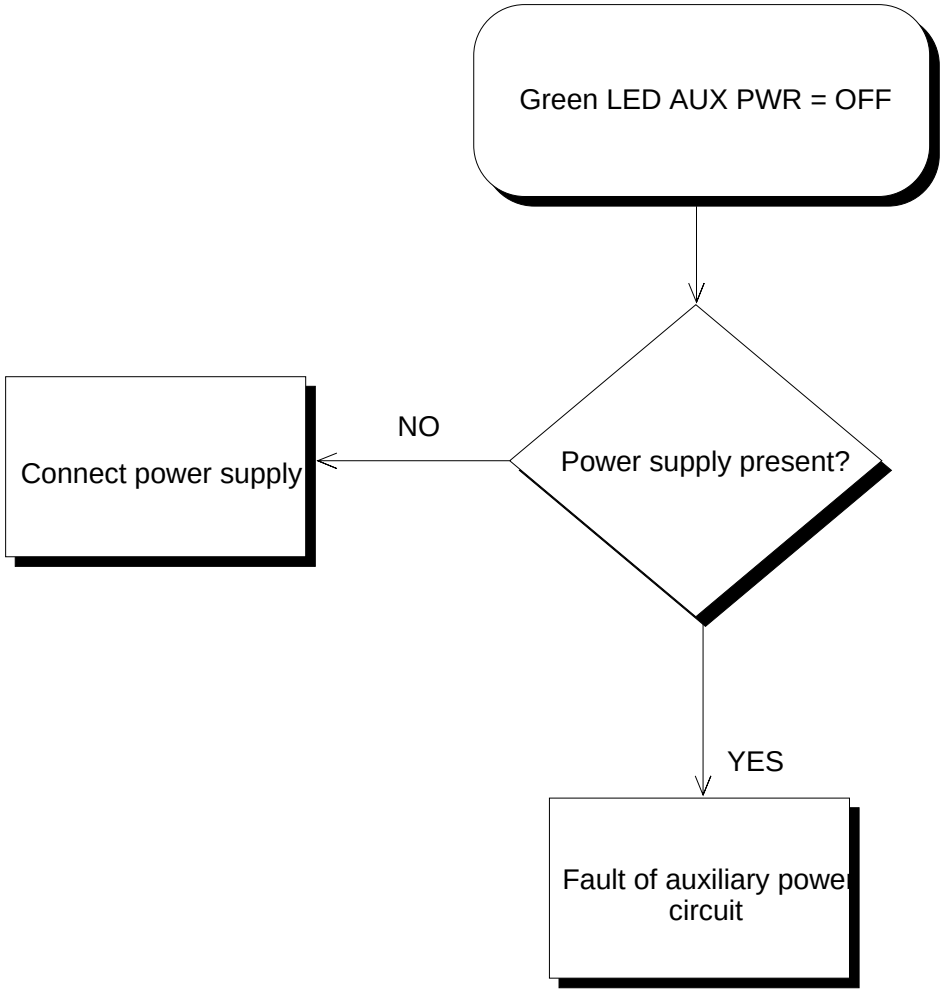


FIG. 4.5 - REF EN green LED off
Reference Enable

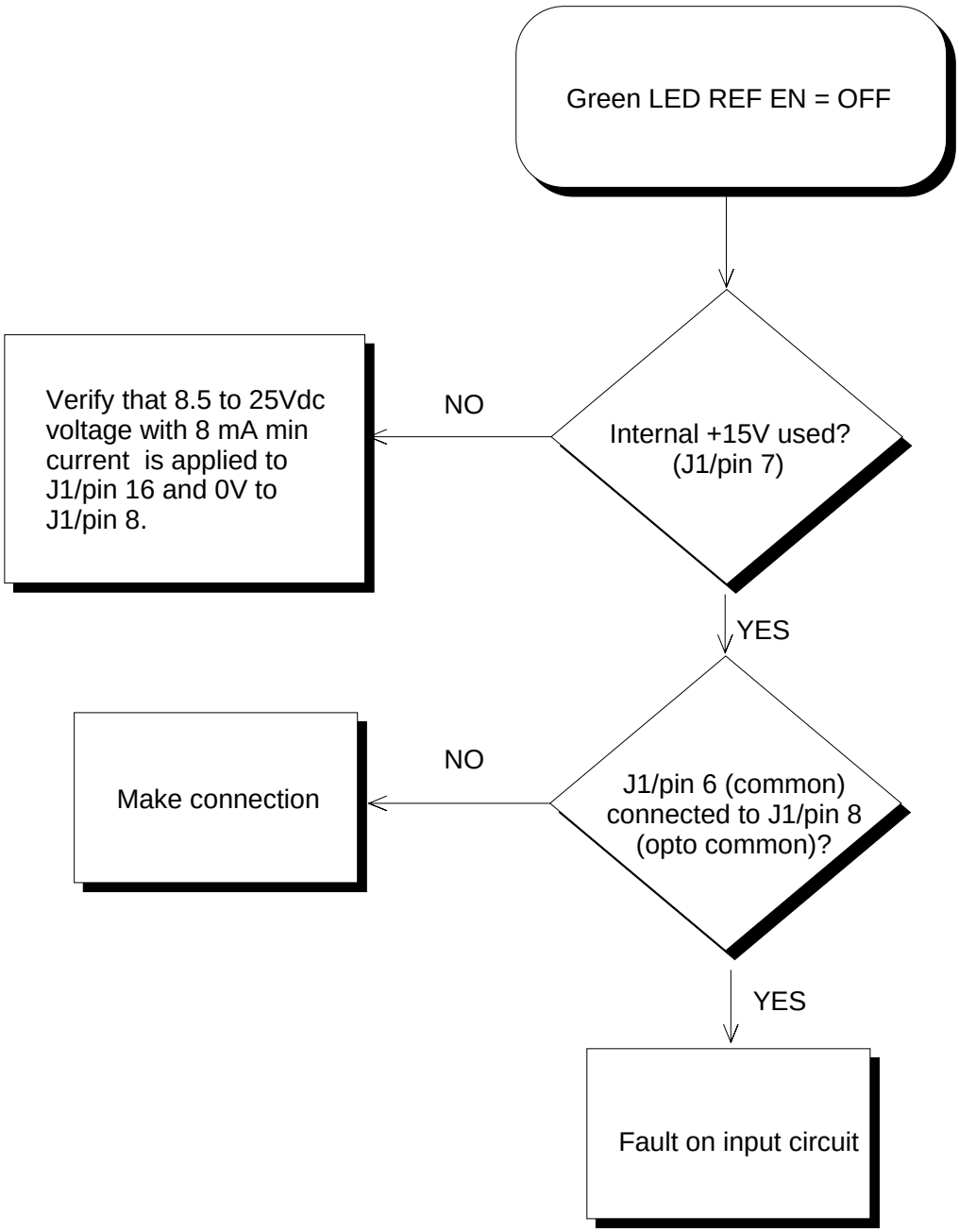


FIG. 4.6 - DRV EN green LED off
Drive Enable

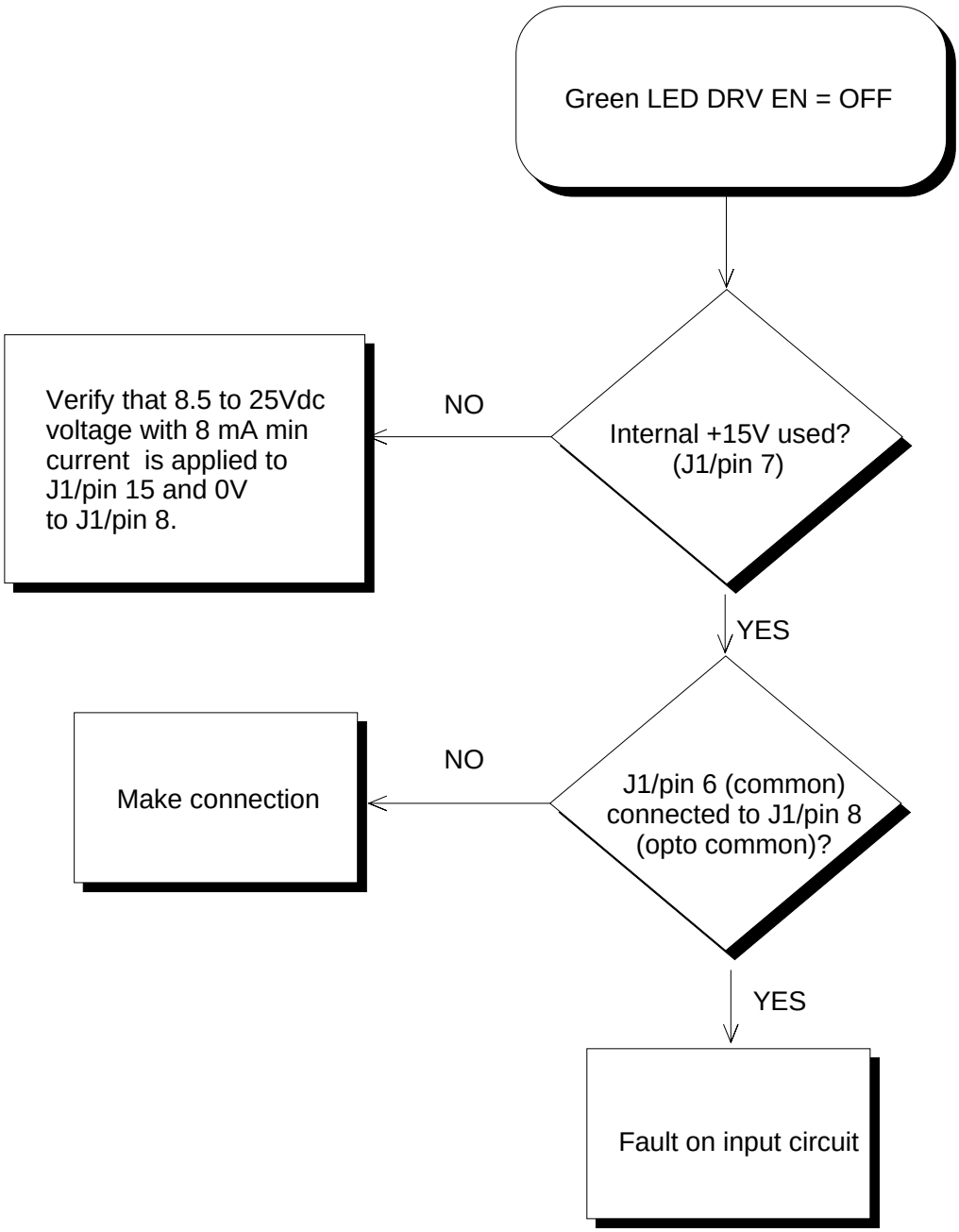


FIG. 4.7 - M OVT red LED on
Motor Overtemperature

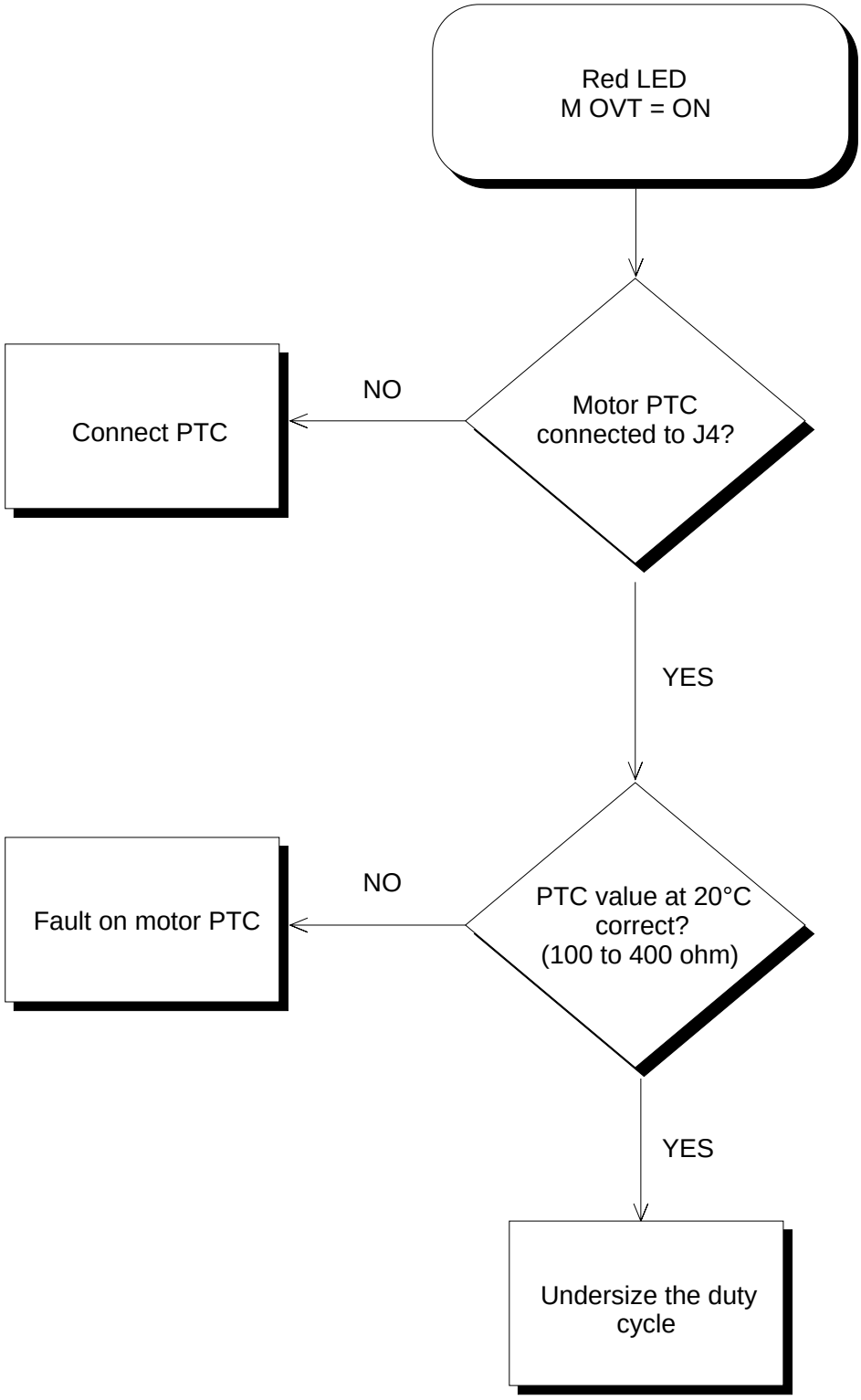


FIG. 4.8 - WTD red LED on Watch Dog

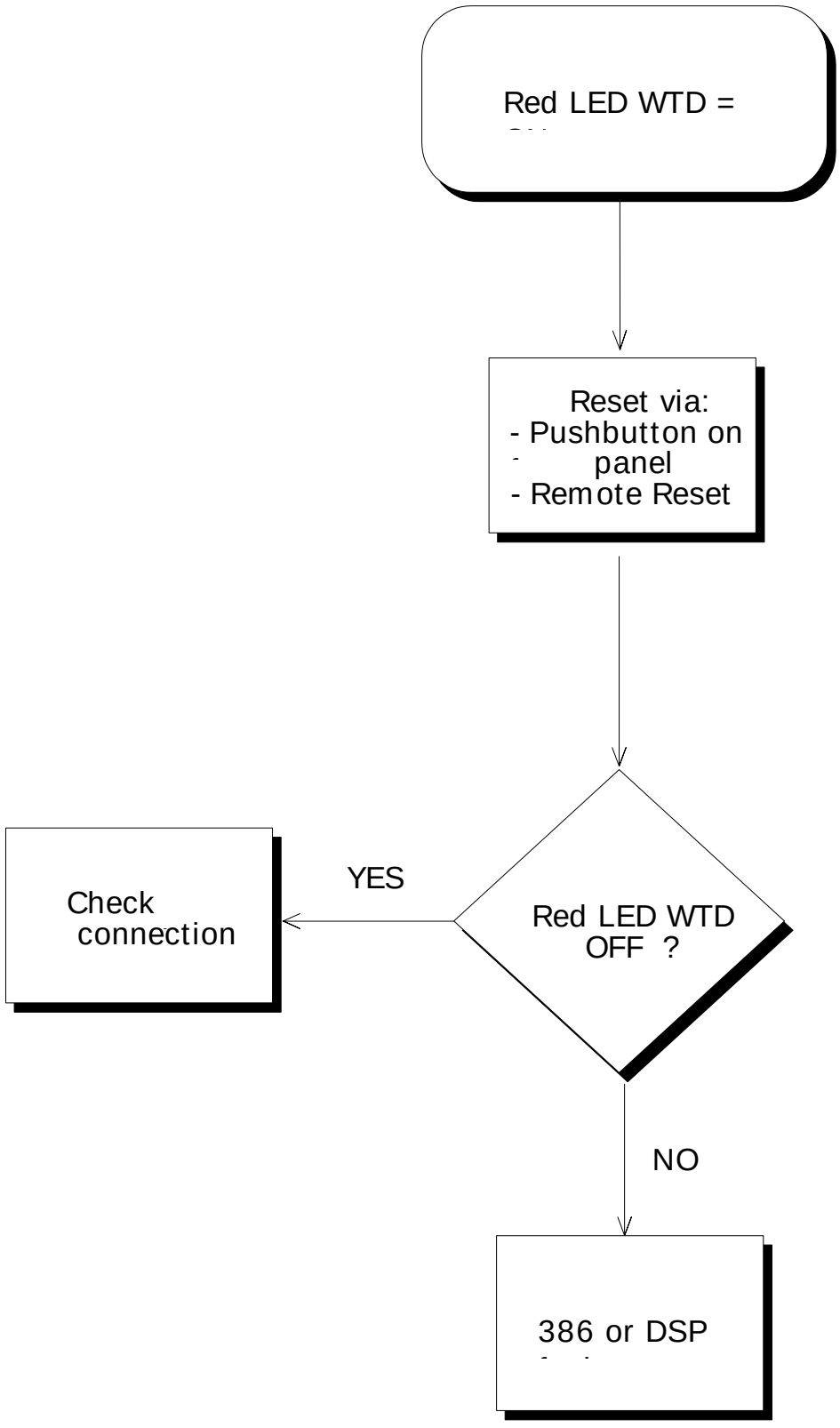


FIG. 4.9 - DRV OVT red LED on
Drive Overtemperature

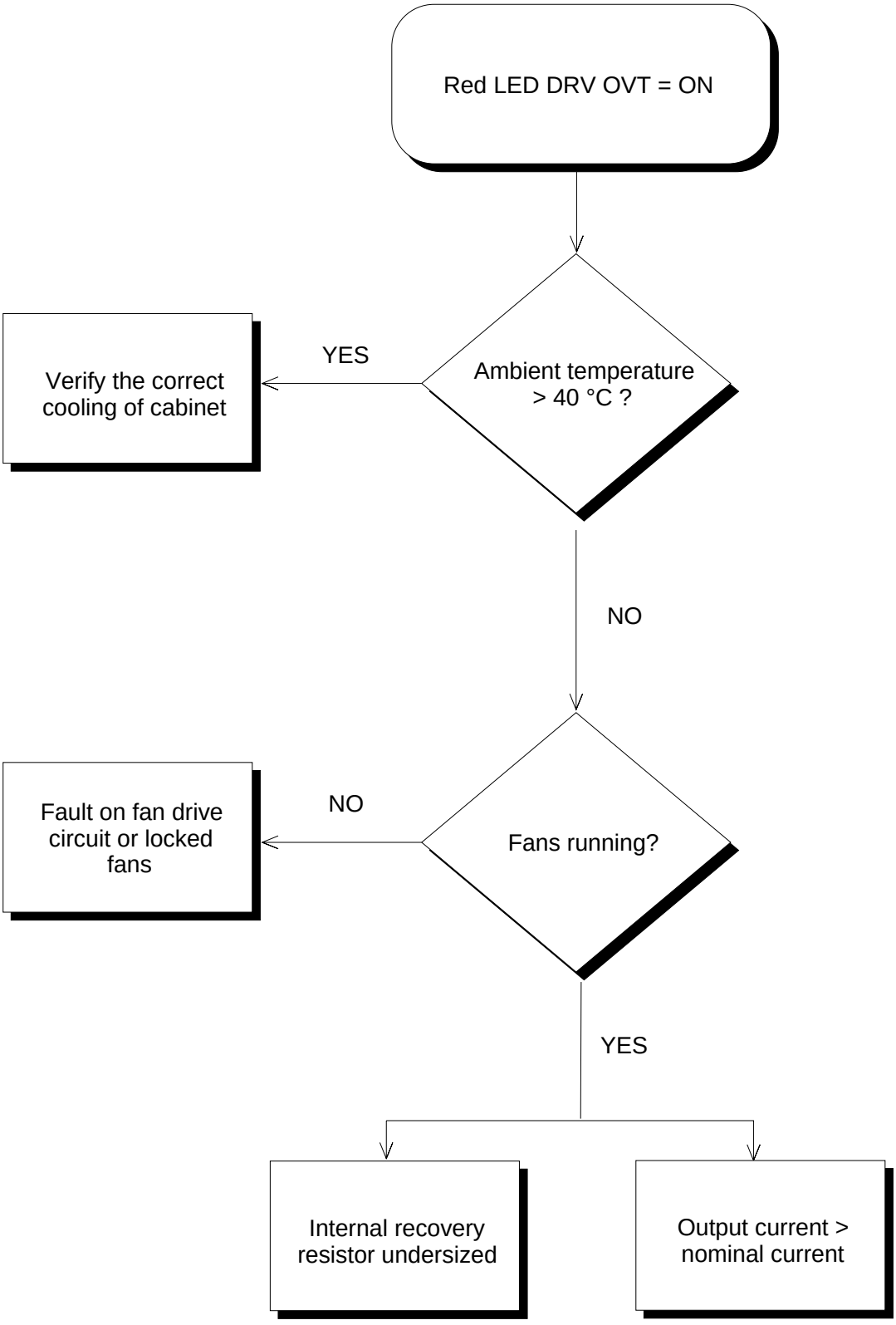


FIG. 4.10 - PWR FAULT red LED on
Short Circuit or Locked Rotor

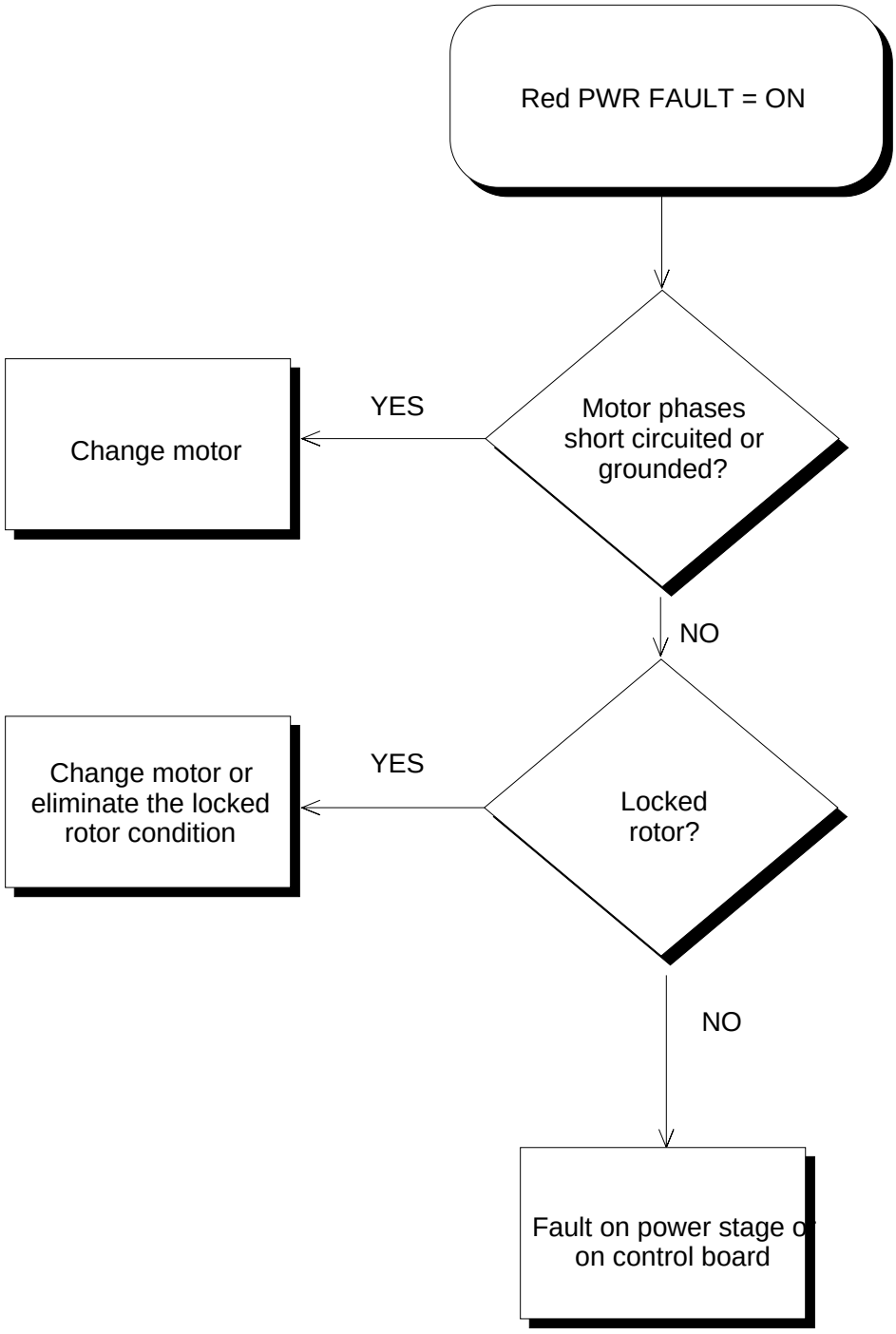


FIG. 4.11 - RES FAULT red LED on
Resolver Fault

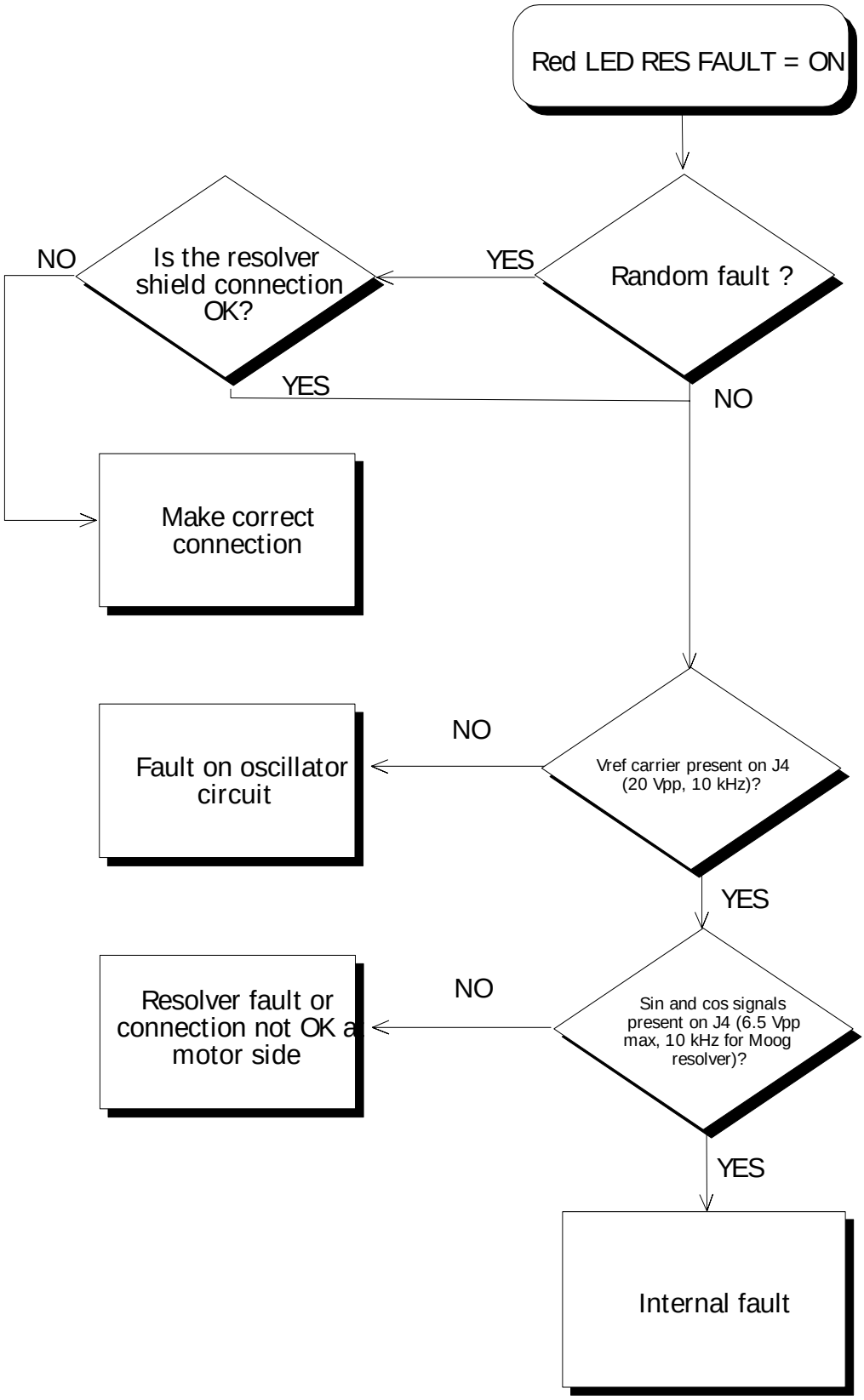


FIG. 4.12 - DRIVE FAULT red LED on

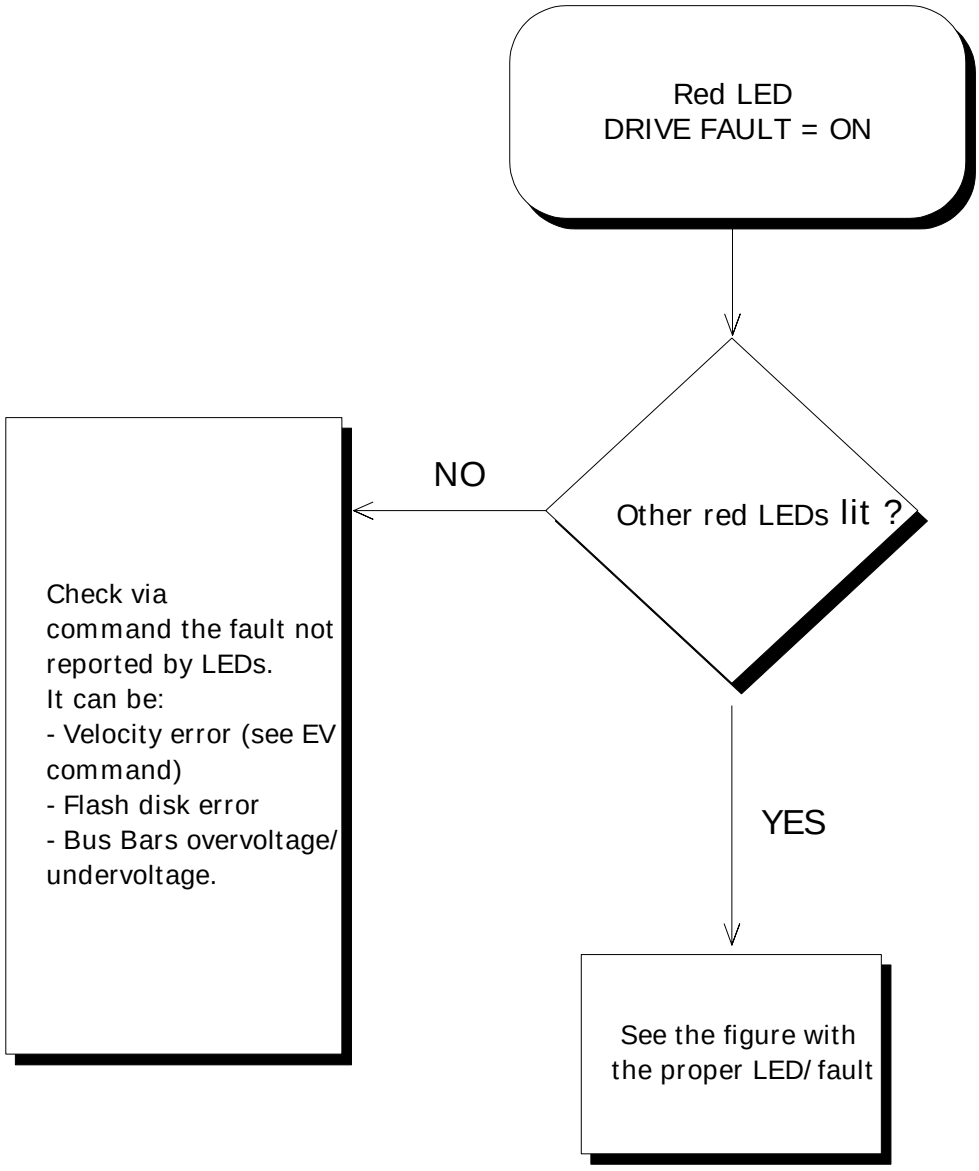


FIG. 4.13 - Motor vibrates

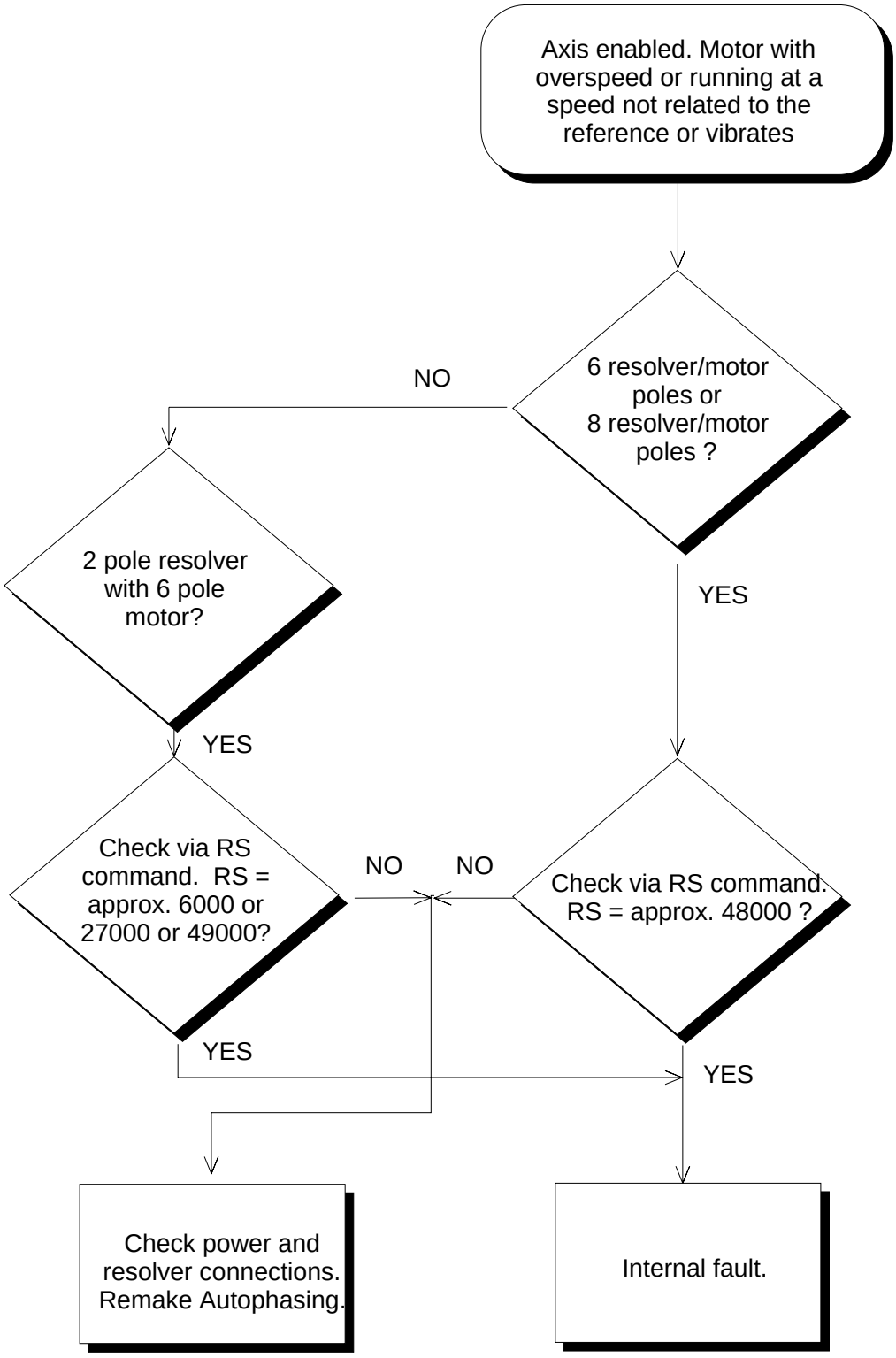


FIG. 4.14 - Communication fault

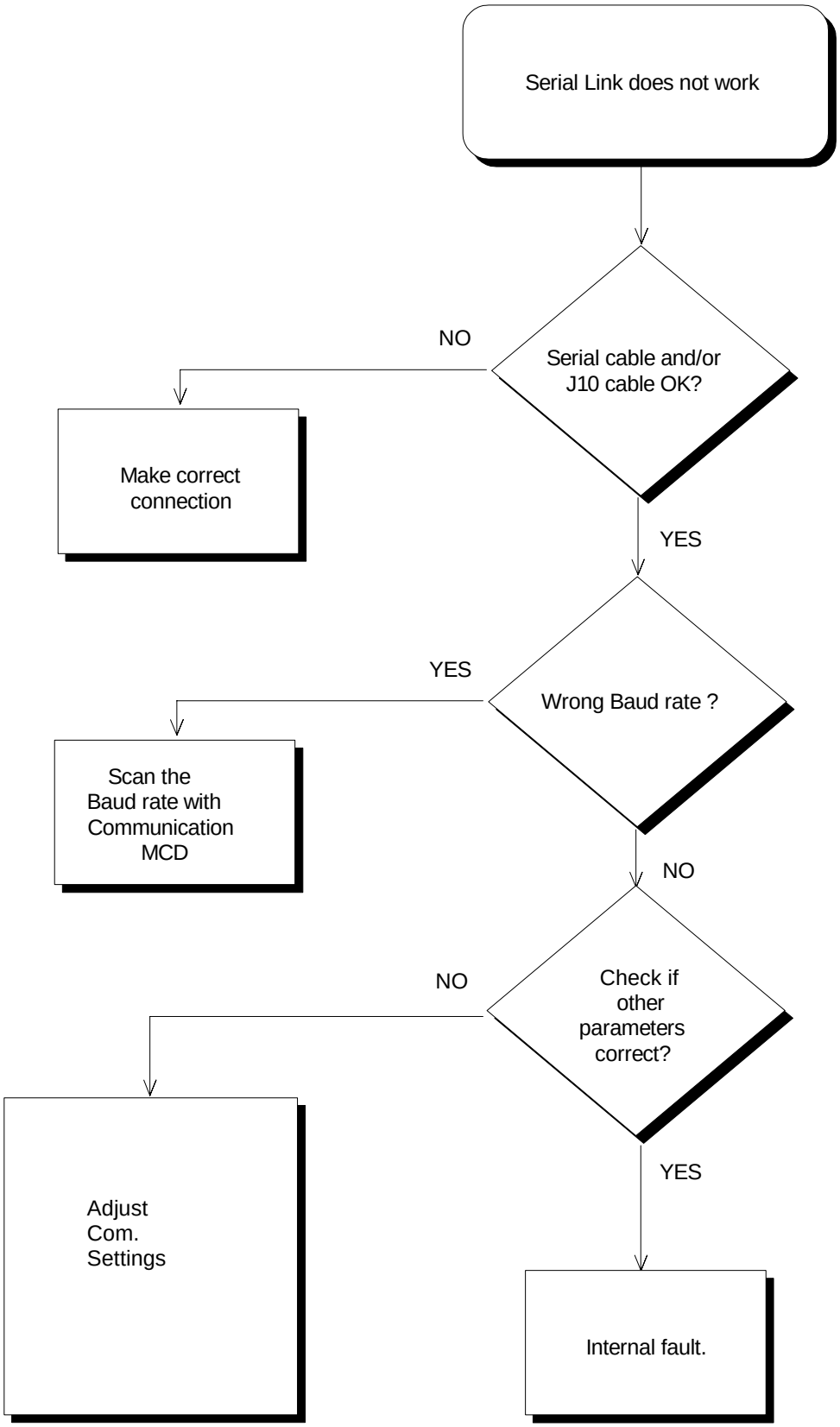


FIG. 4.15 - Motor at zero speed

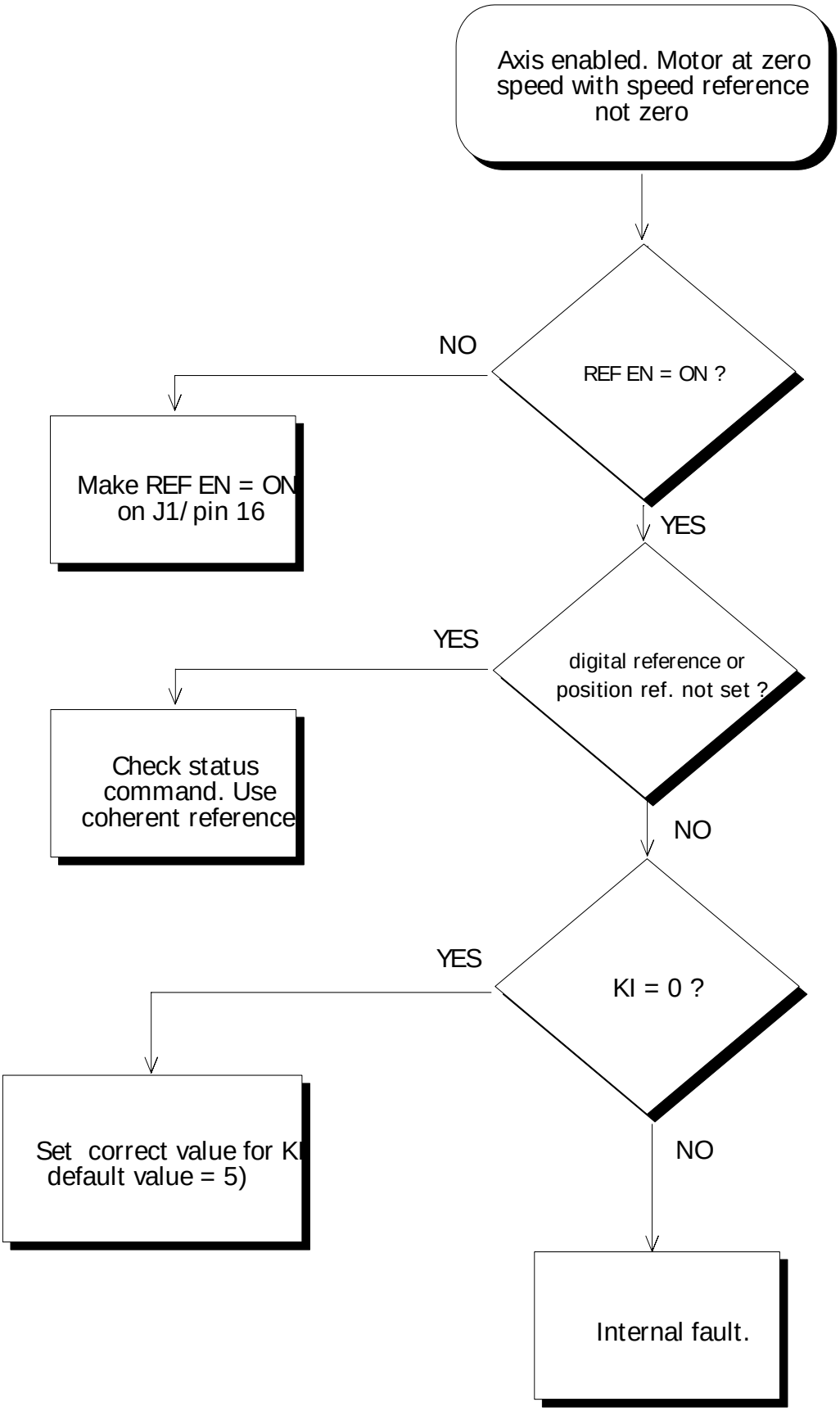


FIG. 4.16 - IT red LED on

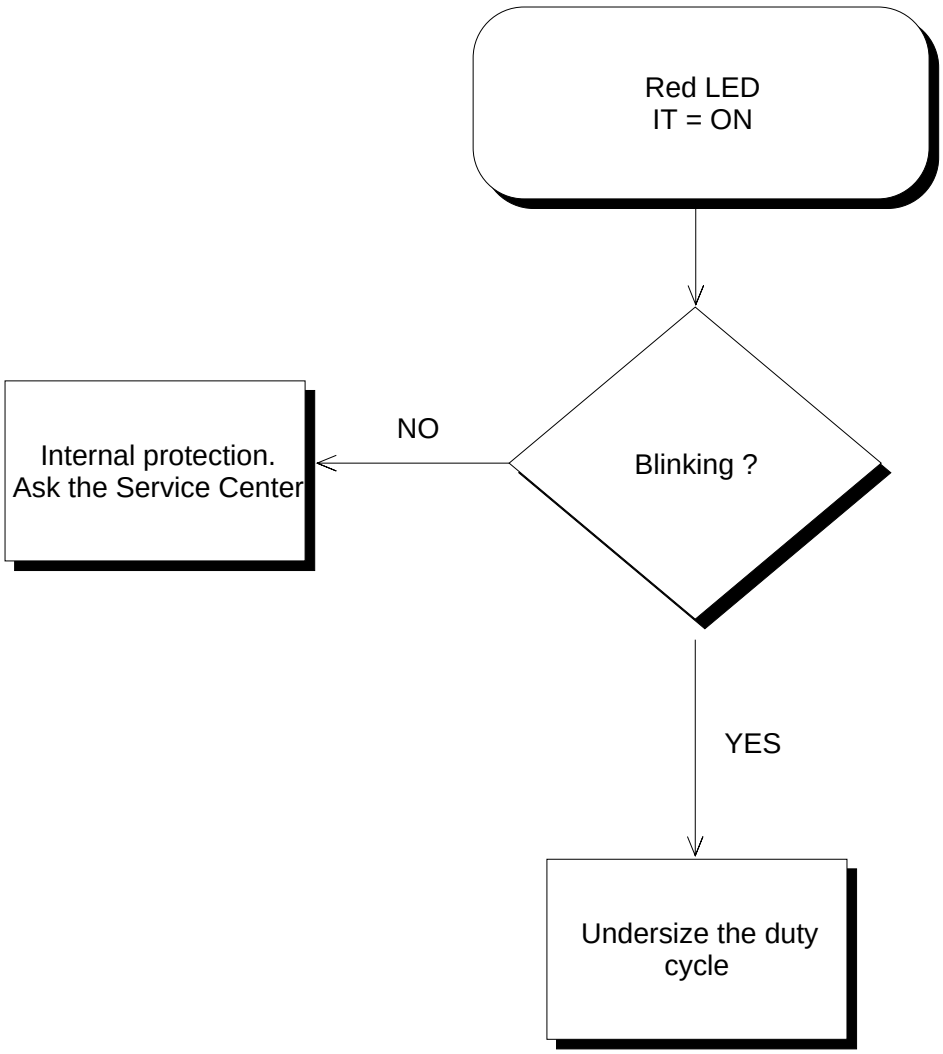
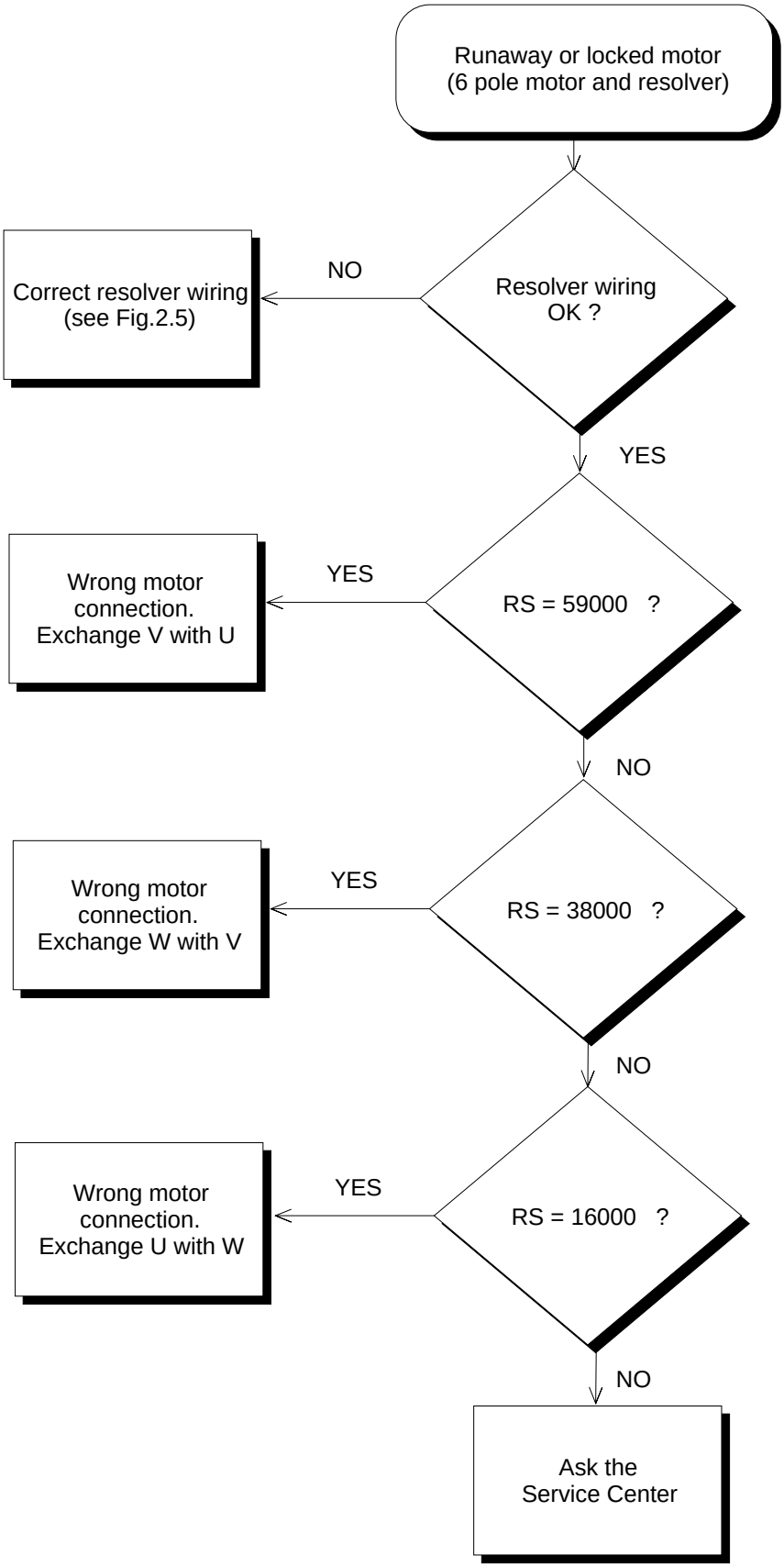


FIG. 4.17 - Runaway or Locked motor (6 pole motor and resolver)



5. COMMANDS

CONTENTS

- VERSION DOCUMENTATION

3.11	**NOT RELEASED** :	February 2001, Stephan Schwarz, ProControl AG
	Docu extended:	IDBx Code Box Motor safety brake
	SDO extensions:	0x100500: Synchronization COB-ID 0x100600: Synchronization cycle period 0x100700: Synchronization window length
3.10	**RELEASED** :	January 2001, Stephan Schwarz, ProControl AG
	Docu extended:	IDBx Code Box Motor safety brake
	SDO extensions:	0x20?0.1B: KP factor during motor turn off 0x20?0.1C: KI factor during motor turn off 0x20?1.0E: Set input filter time constant factor 0x20?1.0F: Shape control type (Standard, S-, Bell-, Sin²Shape) 0x20?1.10: Shape switching time period
3.08	**RELEASED** :	February 2000, Stephan Schwarz, ProControl AG
	SDO extensions:	0x2009.01: IDBx Module digital software input param. 0x20?1.0E: Position interpolation time base Error / Warning Messages
3.07	**RELEASED** :	31. January 2000, Stephan Schwarz, ProControl AG
3.06	**RELEASED** :	31. Januar 2000, Stephan Schwarz, ProControl AG
	Docu extended:	IDBx module connector pin assignment IDBx module configurations
	SDO extensions:	0x2000.05: Hardware definition table access 0x2000.06: Drive data base access 0x2000.07: Motor data base access 0x2007.??: IDBx-Module digital output parameter 0x2008.??: IDBx-Module digital input parameter 0x2100.04: Matrix input signals for digital outputs 0x2100.05: Matrix output signals for digital inputs 0x20?0.16: Drive load level scale factor 0x20?0.17: Motor load level scale factor 0x20?0.18: Brake open time 0x20?0.19: Brake nominal activation time 0x20?0.1A: Brake maximal activation time
	Error corrections:	0x20?0.06: DSP command ramp up 0x20?0.07: DSP command ramp down
3.05	**RELEASED** :	07. Oktober 1999, Stephan Schwarz, ProControl AG
	SDO extensions :	SDO-Obj 0x1003: Pre-defined error field SDO-Obj 0x1001: Error register
3.04	**RELEASED** :	27. September 1999, Stephan Schwarz, ProControl AG redefined SDO object dictionary for motion profile
3.03	**RELEASED** :	28. Juli 1999, Stephan Schwarz, ProControl AG
	SDO extensions :	0x2000.04: Read/Write RTC date/time

0 Communication Services

0.1 General

The MCD profile provides the following communication services according to CANopen. Some of these services are available in particular device operation modes. After power-on and startup of the application program the device is in mode „Pre-Operational“.

Services supported by the MCD devices:

Node state	Communication service provided by the IDBx devices
Disconnected	None
Connecting	Node-Guarding
Preparing	Node-Guarding, NMT, 1.SDO, 2.SDO
Prepared	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY
Pre-Operational	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY, SYNC
Operational	Node-Guarding, NMT, 1.SDO, 2.SDO, EMERENCY, SYNC, TxPDO, RxPDO

0.2 Network Management NMT

The MCD device is supporting the following NMT commands. After execution of the commands the application remains in the node state as defined to wait for other NMT commands:

NMT command	NMT command number	Node state after execution of command
Reset Communication	130	Pre-Operational
Reset Remote Node	129	Pre-Operational
Initialization Remote Node	128	Pre-Operational
Stop Remote Node	2	Prepared
Start Remote Node	1	Operational

0.3 Synchronization Object SYNC

The MCD device is supporting synchronization object. The synchronization object is broadcasted periodically by the SYNC producer. This SYNC provides the basic network clock. The time period between the SYNCs is specified by the standard parameter **communication cycle period** (see Object 1006h: Communication Cycle Period*),* which may be written by a configuration tool to the application devices during the boot-up process.

0.4 Node Guarding Object

The CAN bus master uses the node guard telegram to determine the current node state of the IDBx device. This is done by a periodical transmission of the Request Telegramm to the device. Based on this telegram a network timeout control for both master and slave may be implemented.
The IDBx device returns the following node state indications:.

Mode	Number
Disconnected	1
Connecting	2
Preparing	3
Prepared	4
Operational	5
Pre-Operational	127

0.5 Emergency Object

Internal error conditions (Hardware, Software) of the device are submitted to the master by the *Emergency Telegramm*.

0.6 Service Data Object SDO

The Service Data Object SDO provides access to the device's object dictionary using index and sub-index. The MCD device supports two SDO channels.

0.7 Process Data Object PDO

With the MCD device in the state *Operational,* up to 4 Receive PDO and 4 Transmit-PDO are active. These telegrams provide the exchange of process data, usually at high priority as a non confirmed service. The data structure within these PDO may vary based on the current device node state.

0.7.1 Transmission types

Type	Transmission
0	Synchronous, acyclic
252	Synchronous, RTR only
253	Asynchronous, RTR only
254	Asynchronous

1 Module Identification (Node ID)

1.1 Identifier Distribution

The *CAN Communication Object Identifiers* COB-ID are usually based on the Node ID of the device. However, the COB-IDs may still be modified after device startup by SDO access. As soon as the Node ID of a IDBx device is changed, the COB-IDs are initialized as follows:

Communication Objects	COB-ID	Assignment
NMT	0x000	Module
SYNC	0x080	
EMERGENCY	0x080 + Module address	
Nodeguard	0x700 + Module address	
1. TxPDO	0x180 + Module address	Axis 1
1. RxPDO	0x200 + Module address	
2. TxPDO	0x280 + Module address	Axis 2
2. RxPDO	0x300 + Module address	
3. TxPDO	0x380 + Module address	Axis 3
3. RxPDO	0x400 + Module address	
4. TxPDO	0x480 + Module address	Reserve
4. RxPDO	0x500 + Module address	
1. TxSDO	0x580 + Module address	1. SDO-Cannel for the module
1. RxSDO	0x600 + Module address	
2. TxSDO	0x680 + Module address	2. SDO-Cannel for the module
2. RxSDO	0x780 + Module address	

1.2 Module Address (Node ID)

The MCD device node ID is to be set using the **IDBx Code-Box, MCD Commander** or **Term** (RS232 terminal program). The Node ID value must be between 1 and 127, it set to 63_d ($3F_h$) by default.

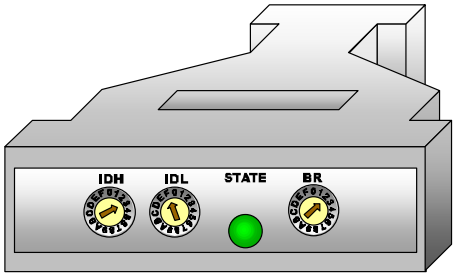
1.3 Module Baud Rate

Communication speed can be selected within the **IDBx Code-Box, MCD Commander** or **Term** (RS232 terminal program). The maximum baud rate is determined by the actual CAN bus length. The baud rate is initially set to 500 kBit/s. The following speed settings are supported by CANopen:

CANopen Index	Baud rate [kBit/s]	Max. Bus Length [m]	Bit-Time [us]
0	1000	25	1.00
1	800	50	1.25
2	**500**	100	2.00
3	250	250	4.00
4	125	500	8.00
5	50	1000	20.00
6	20	2500	50.00
7	10	5000	100.00

1.4 IDBx Code-Box

The node ID and communication baud rate will be selected by the IDH/IDL- and BR-Switch-Selector. Connect the IDBx Code-Box to the RS485 connector J2 and restart the MCD module by pressing the reset button and wait for flashing the green state LED.



Label	Assignment	Description
IDH IDL	Node ID selector (HEX switch selector)	To select the node ID 63_d, set the IDH-Switch to 3 and the IDL-Switch to F. ($63_d = 3F_h$) *1.2 Module Address (Node ID)*
STATE	Three color LED	Red: Error exist (wrong ID, BR or com.) Yellow: Wait for reposing Green: ID and BR accepted and initialized
BR	Baud rate selector (HEX switch selector)	To select the baud rate 500[kBit/s] set the BR-Switch to number 2 *1.3 Module Baud Rate*

1 Module Identification (Node ID)

1.1 Identifier Distribution

The *CAN Communication Object Identifiers* COB-ID are usually based on the Node ID of the device. However, the COB-IDs may still be modified after device startup by SDO access. As soon as the Node ID of a IDBx device is changed, the COB-IDs are initialized as follows:

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NMT	0x000	Module
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2. TxPDO	0x280 + Module address	Axis 2
2. RxPDO	0x300 + Module address	
3. TxPDO	0x380 + Module address	Axis 3
3. RxPDO	0x400 + Module address	
4. TxPDO	0x480 + Module address	Reserve
4. RxPDO	0x500 + Module address	
1. TxSDO	0x580 + Module address	1. SDO-Cannel for the module
1. RxSDO	0x600 + Module address	
2. TxSDO	0x680 + Module address	2. SDO-Cannel for the module
2. RxSDO	0x780 + Module address	

1.2 Module Address (Node ID)

The MCD device node ID is to be set using the **IDBx Code-Box, MCD Commander** or **Term** (RS232 terminal program). The Node ID value must be between 1 and 127, it set to 63_d ($3F_h$) by default.

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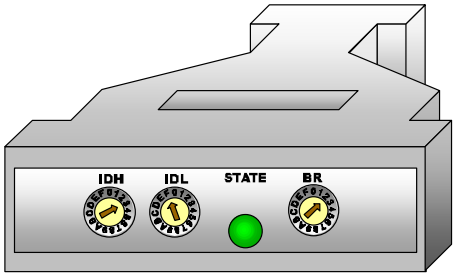
CANopen Index	Baud rate [kBit/s]	Max. Bus Length [m]	Bit-Time [us]
0	1000	25	1.00
1	800	50	1.25
2	**500**	100	2.00
3	250	250	4.00
4	125	500	8.00
5	50	1000	20.00
6	20	2500	50.00
7	10	5000	100.00

1.4 IDBx Code-Box

The node ID and communication baud rate will be selected by the IDH/IDL- and BR-Switch-Selector. Connect the IDBx Code-Box to the RS485 connector J2 and restart the MCD module by pressing the reset button and wait for flashing the green state LED.



Label	Assignment	Description
IDH IDL	Node ID selector (HEX switch selector)	To select the node ID 63_d, set the IDH-Switch to 3 and the IDL-Switch to F. ($63_d = 3F_h$) *1.2 Module Address (Node ID)*
STATE	Three color LED	Red: Error exist (wrong ID, BR or com.) Yellow: Wait for reposing Green: ID and BR accepted and initialized
BR	Baud rate selector (HEX switch selector)	To select the baud rate 500[kBit/s] set the BR-Switch to number 2 *1.3 Module Baud Rate*

2.2 Manufacturer Specific Profile Definitions

2000	6	IDBx-Module set parameters
2001	3	IDBx-Module analog output 1. configuration parameter structure
2002	3	IDBx-Module analog output 2. configuration parameter structure
2003	3	IDBx-Module analog output 3. configuration parameter structure
2004	3	IDBx-Module analog output 4. configuration parameter structure
2005	3	IDBx-Module analog output 5. configuration parameter structure
2006	3	IDBx-Module analog output 6. configuration parameter structure
2007	4	IDBx-Module digital output configuration parameter structure
2008	6	IDBx-Module digital input configuration parameter structure
2009	1	IDBx-Module digital software input configuration parameter structure
2010	1C	IDBx-Axis 1 set parameters (e. g. resolver poles, speed gain KP ..)
2011	10	IDBx-Axis 1 motion control parameters (MotionCtrlMode,SetPos, Accel,Posgain, prof# ..)
2012	3F	IDBx-Axis 1 motion profile table (velocty profile tables: motor angle, SetRPM, Acceleration)
2020	1C	IDBx-Axis 2 set parameters
2021	10	IDBx-Axis 2 motion control parameters
2022	3F	IDBx-Axis 2 motion profile table
2030	1C	IDBx-Axis 3 set parameters
2031	10	IDBx-Axis 3 motion control parameters
2032	3F	IDBx-Axis 3 motion profile table
2100	5	IDBx-Module actual values
2101	3	IDBx-Module common values
2110	9	IDBx-Axis 1 actual values
2111	4	IDBx-Axis 1 auto phasing
2120	9	IDBx-Axis 2 actual values
2121	4	IDBx-Axis 2 auto phasing
2130	9	IDBx-Axis 3 actual values
2131	4	IDBx-Axis 3 auto phasing

2.3 IDBx-Module Set Parameters

Index [h]	Sub [h]	Description				
2000	00	IDBx-Module set parameters			7[h]	Uns8
	01	IDBx-Model description			127 Characters	Visible String
	02	IDBx-Module type			1: IDBm, 2: IDBs 3kHz, 3: IDBs 9kHz	Int32
	03	Number of axes at IDBx-Module			1..3	Int32
	04	Date and Time			sec. elapsed since midnight 00:00:00, 1. 1. 1970	Int32
	05	Hardware defintion table			HWdefine,INI	Domain
	06	Drive data base			IDBxDrv,INI	Domain
	07	Motor data base			IDBxMot,INI	Domain
2001	00	IDBx-Module analog output 1. Parameter			3[h]	Uns8
2002	00	IDBx-Module analog output 2. Parameter			3[h]	Uns8
2003	00	IDBx-Module analog output 3. Parameter			3[h]	Uns8
2004	00	IDBx-Module analog output 4. Parameter			3[h]	Uns8
2005	00	IDBx-Module analog output 5. Parameter			3[h]	Uns8
2006	00	IDBx-Module analog output 6. Parameter			3[h]	Uns8
	01	Analog output value			-32768..32767	Int32
	02	Analog output address			0x00..0x2FF	Int32
	03	Analog output gain			0..31	Int32
2007	00	IDBx-Module digital output Parameter			4[h]	Uns8
	01	Dout 0	IDBm J1pin13,	IDBs J1pin14	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	02	Dout 1	IDBm J7pin31,	IDBs J1pin14	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	03	Dout 2	IDBm J7pin32,	IDBs J3pin8	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
	04	Dout 3	IDBm J7pin33		Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Output	Uns32
2008	00	IDBx-Module digital input Parameter			6[h]	Uns8
	01	Dinp 0	IDBm J8pin17,	IDBs J1pin16	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	02	Dinp 1	IDBm J8pin14,	IDBs J1pin15	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	03	Dinp 2	IDBm J8pin15,	IDBs J1pin18	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	04	Dinp 3	IDBm J8pin16,	IDBs J3pin1	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	05	Dinp 4		IDBs J3pin12	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
	06	Dinp 5		IDBs J3pin7	Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32
2009	00	IDBx-Module digital software input Para.			1[h]	Uns8
	01	Dswi			Bit 0..29 Matrix, Bit 30 Inverter, Bit 31 Input (RO)	Uns32

2.4 IDBx-Module Actual Parameters

Index [h]	Sub [h]	Description				
2100	00	IDBx-Module actual values			5[h]	Uns8
	01	Error register			Error Messages:	Uns32
	02	Warning register			Warning Messages	Uns32
	03	DSP version number				Uns32
	04	Matrix input signals for digital outputs				Uns32
	05	Matrix output signals for digital inputs				Uns32
2101	00	IDBx-Module common values			3[h]	Uns8
	01	Start up date			40 Characters	Visible String
	02	Customer name			40 Characters	Visible String
	03	Module series number			40 Characters	Visible String

2.5 IDBx-Axes Set Parameters

Index [h]	Sub [h]	Description			
2010	00	IDBx-Axis 1 set parameters	1C[h]		Uns8
2020	00	IDBx-Axis 2 set parameters	1C[h]		Uns8
2030	00	IDBx-Axis 3 set parameters	1C[h]		Uns8
	01	Axis description	127 Characters		Visible String
	02	Drive type (3/9)	20 Characters		Visible String
	03	Motor type (FASW2-K8-031)	20 Characters		Visible String
	04	Max. Motor velocity	0..30000 [1/min]		Int32
	05	Error motor velocity	0..MaxVel [1/min]		Int32
	06	DSP command ramp up	0..3000 [1/min/111us] PFOC -3000..0 [1/min /0.1s]		Int32
	07	DSP command ramp down	0..3000 [1/min/111us] PFOC -3000..0 [1/min /0.1s]		Int32
	08	Motor torque limit	0..100 [%]		Int32
	09	Current peak limit	0..100 [%]		Int32
	0A	Velocity filter KF1	0..30		Int32
	0B	Velocity filter KF2	0..30		Int32
	0C	Velocity control P-Gain during motor on	0..30		Int32
	0D	Velocity control I-Gain during motor on	0..30		Int32
	0E	Current control Gain	0..3		Int32
	0F	Resolver angle offset	-32768..32767		Int32
	10	Resolver poles	2, 4, 6, 8		Int32
	11	Motor poles to Resolver poles	1..4		Int32
	12	Max. Resolver resolution	0: 10, 1: 12, 2: 14, 3: 16Bit		Int32
	13	Simulated Encoder output	0..7 (128, 256..16384) [counts/U]		Int32
	14	Motor turn direction	0 : clockwise, 1: counter clockwise		Int32
	15	Velocity Torque Mode	0: Velocity, 1: Torque		Int32
	16	Drive load level scale factor	600..2000 [0.1%]	(default 1000)	Int32
	17	Motor load level scale factor	600..2000 [0.1%]	(default 1000)	Int32
	18	Brake release, open time	0..1000 [ms]	0 = default value 200ms	Int32
	19	Brake nominal activation time	0..1000 [ms]	0 = default value 200ms	Int32
	1A	Brake maximal activation time	0..1000 [ms]	0 = default value 500ms	Int32
	1B	Velocity control P-Gain during motor off	0..30		Int32
	1C	Velocity control I-Gain during motor off	0..30		Int32
2011	00	IDBx-Axis 1 motion control parameters	10[h]		Uns8
2021	00	IDBx-Axis 2 motion control parameters	10[h]		Uns8
2031	00	IDBx-Axis 3 motion control parameters	10[h]		Uns8
	01	Motion Control Mode	0..7		Int32
	02	Position	-PosRange..+PosRange [counts]		Int32
	03	Position tolerance window	0..PosRange [counts]		Int32
	04	Velocity, Torque command	+/-32767 [1/min, 15BitDAC]		Int32
	05	Torque limit	0..127 [7BitDAC] = 0..100%		Int32
	06	Acceleration	0..10000 [1/min /ms]		Int32
	07	Deceleration	0..10000 [1/min /ms]		Int32
	08	Position gain	5..1000 [1/s]		Int32
	09	Variable profile set position	0, 1		Int32
	0A	Profile number	0..3		Int32
	0B	Profile velocity scale	0..100 [%]		Int32
	0C	Profile min velocity outside profile	0..255 [1/min]		Int32
	0D	Profile dynamic compensation time	0..10000 [us]		Int32
	0E	Position interpolation time base	0..10000 [ms]		Int32
	0F	Shape type	0 : Standard, 1 :S-, 2 :Bell-, 3 :Sin²Shape		Int32
	10	Shape switching period time	0..10000 [ms]		Int32
2012	00	IDBx-Axis 1 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4		Uns8
2022	00	IDBx-Axis 2 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4		Uns8
2032	00	IDBx-Axis 3 motion profile tables	0x3F: 0x01..0x0F = Profile 1 0x10..0x1F = Profile 2 0x20..0x2F = Profile 3 0x30..0x3F = Profile 4		Uns8
	01	Profile description	127 Characters		Visible String
	02	Profile size	0 = not exist, 1..		Int32
	03	Profile move direction	-1: negative, +1: positive		Int32
	04	Profile move time	[ms]		Int32
	05	Profile position gain	[1/s]		Int32
	06	Profile stroke	[counts]		Int32
	07	Profile start position	[counts]		Int32
	08	Profile end position	[counts]		Int32
	0F	Profile table			Domain

2.6 IDBx-Axes Actual Parameters

Index [h]	Sub [h]	Description		
2110	00	IDBx-Axis 1 actual values	9[h]	Uns8
2120	00	IDBx-Axis 2 actual values	9[h]	Uns8
2130	00	IDBx-Axis 3 actual values	9[h]	Uns8
	01	Error register	Error Messages	Uns32
	02	Warning register	Warning Messages	Uns32
	03	Position	[counts]	Int32
	04	Velocity	[1/min]	Int32
	05	Torque	[0.1 Nm]	Int32
	06	Motor load level	[0.1 %]	Int32
	07	Drive section load level	[0.1 %]	Int32
	08	PWM Water valve output	[0.1 %]	Int32
	09	Torque resolution	[0.1 Nm/ max Irms]	Int32
2111	00	IDBx-Axis 1 Autophasing	4[h]	Uns8
2121	00	IDBx-Axis 2 Autophasing	4[h]	Uns8
2131	00	IDBx-Axis 3 Autophasing	4[h]	Uns8
	01	Start, Finish, Abort sequence	Start = 1, Finish = 2, Abort = 0	Int32
	02	State	0..8	Int32
	03	Error	0..3	Int32
	04	Resolver offset	-32768..32767 = -180..180° electric angle	Int32

3 Motion Control Mode

3.1 Motion Control Mode 0 : Velocity / Torque Control

The RxPDO contains the set speed and the set torque of the axis. With the axis in torque mode only Motion Control Mode 0 is allowed.

3.2 Motion Control Mode 1 : Position Control

The RxPDO contains set speed, set position and the torque limit. Position control type (Standard-, S-, Bell-, Sin²-Shape), acceleration, deceleration and position gain are to be set by SDO communication. All parameters for the position control algorithm (v, s, a, kp) may modified any time, even during movement..

3.3 Motion Control Mode 2 : Profile Control

This operation mode allows to choose from four different velocity profiles for each axis. The profile data are generated from the ProControl Motion Control Analysis Program (BAP). The profile data are stored on the Flash disk using the following file names:

1. Motion Profile	AX1_PROF.I_1	AX2_PROF.I_1	AX3_PROF.I_1
2. Motion Profile	AX1_PROF.I_2	AX2_PROF.I_2	AX3_PROF.I_2
3. Motion Profile	AX1_PROF.I_3	AX2_PROF.I_3	AX3_PROF.I_3
4. Motion Profile	AX1_PROF.I_4	AX2_PROF.I_4	AX3_PROF.I_4

The RxPDO is used to select the Profile Number, Velocity Scaling Factor, Position and Torque Limit.

4 Special Function

4.1 Position Control Shape Type

In the Motion Control Mode 1 (Position Control Mode) are different selectable position control shape types available. The shape type for each axis is set by SDO communication (0x20?1.0F).

4.1.1 Shape Parameter

Parameters	Shape Type support	Limits, Units		SDO index, sub index
Position	0..3	-PosRange..+PosRange	[counts]	Axis 1 0x2011.02 Axis 2 0x2021.02 Axis 3 0x2031.02
Velocity	0..3	-32768..+32767	['/min]	Axis 1 0x2011.04 Axis 2 0x2021.04 Axis 3 0x2031.04
Acceleration	0..3	0..10000	['/min/ms]	Axis 1 0x2011.06 Axis 2 0x2021.06 Axis 3 0x2031.06
Deceleration	0	0..10000	['/min/ms]	Axis 1 0x2011.07 Axis 2 0x2021.07 Axis 3 0x2031.07
Switching period time	1..3	0..10000	[ms]	Axis 1 0x2011.10 Axis 2 0x2021.10 Axis 3 0x2031.10
Position gain	0..3	5..1000	['/s]	Axis 1 0x2011.08 Axis 2 0x2021.08 Axis 3 0x2031.08

4.1.2 Shape Restriction: Type 0 (Standard)

- The switching period time is not supported.
- Acceleration and deceleration parameter can be different and are maximum values

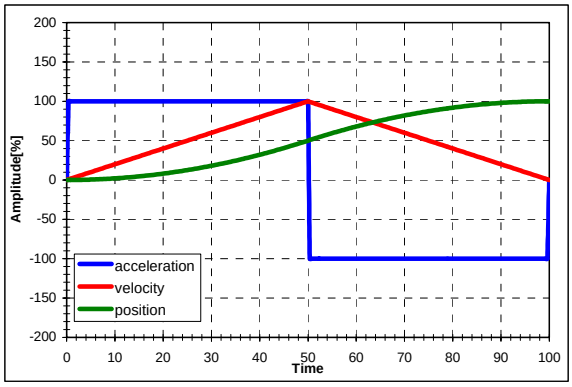
4.1.3 Shape Restriction: Type 1..3 (S-, Bell-, Sin²-Shape)

- Deceleration parameter is not supported.
- Acceleration parameter is used also for deceleration and are average values
- Switching period time = 0 and Acceleration = 0
  This settings produce no moving and are normally not used.
- Switching period time = 0 and Acceleration > 0
  The system changes the velocity with the acceleration parameter (average).
- Switching period time > 0 and Acceleration = 0
  This system changes the velocity in exactly the switch period time.
- Switching period time > 0 and Acceleration > 0
  The effective switch period time conforms with the set one or a multiple of the switch period time.
  The acceleration parameter (average) give a maximum limit for the acceleration.

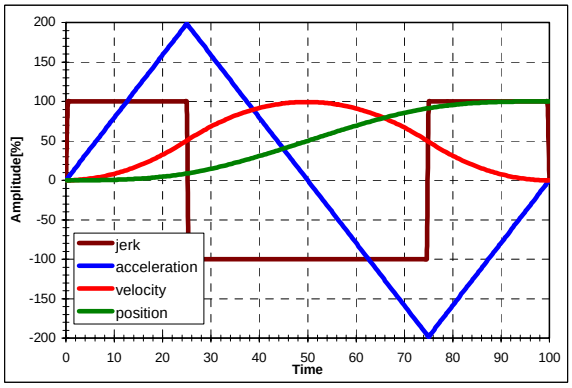
4.1.4 Shape comparison table

Shape Type	Switch period time	Maximum Jerk	Maximum Torque
0 : Standard	No	∞	100%
1 : S-Shape	Yes	100%	200%
2 : Bell-Shape	Yes	113%	150%
3 : Sin^2-Shape	Yes	123%	157%

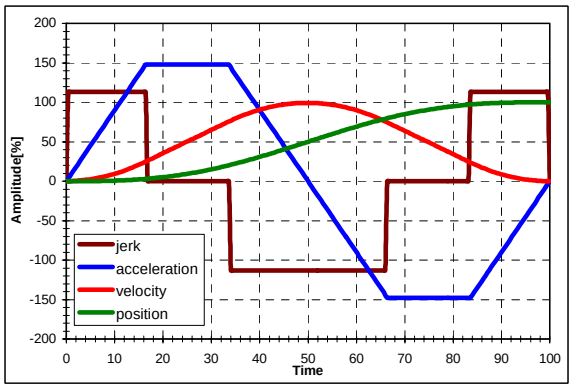
Type 0: Standard



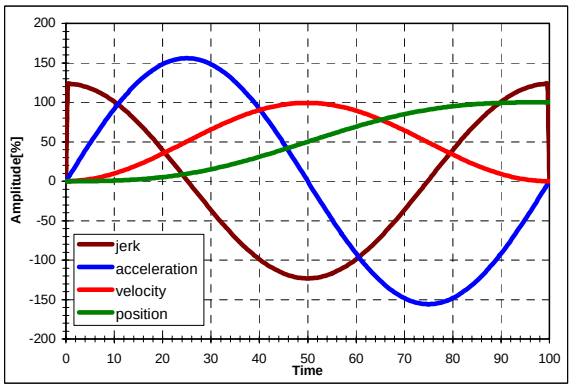
Type 1: S-Shape



Type 2: Bell-Shape



Type 3: Sin²-Shape



4.2 Position Referencing

Position Referencing is applicable in Motion Control Mode 0 and Motion Control Mode 1 only. The direction of the movement is determined by the sign of the set speed and set torque. Based on the Referencing Mode the following actions are possible:

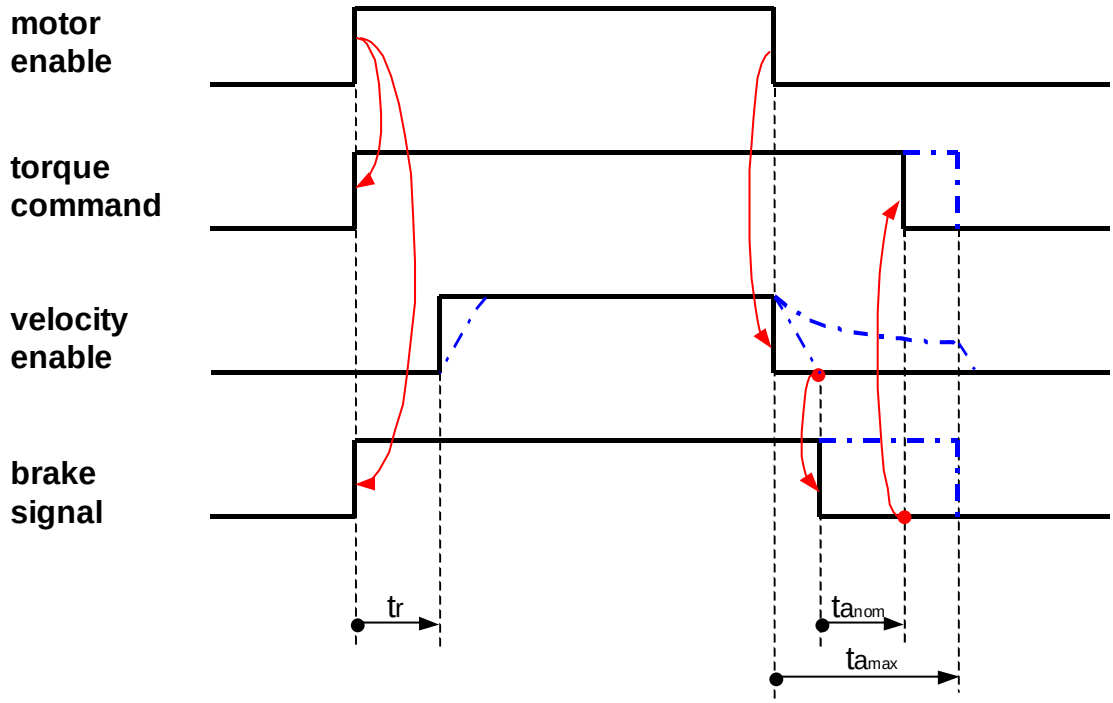
Mode	Description
0	**Referencing not active.** Axis is working in the selected Motion Control Mode.
1	**Referencing active.** Axis moves based on set velocity and torque limit.
2	**Referencing in manual mode.** Uses the actual position of the axis as reference position. Returns automatically to previously used Motion Control Mode.
3	**Referencing using Limit Switch Signal** A limit switch signal is used to define the reference position. Returns to previously used Motion Control Mode after completion.

As soon as Position Referencing is selected, the internal reference position is being erased. Therefore when activating the axis afterwards, the Referencing Mode immediately becomes active.

4.3 Motor safety brake

The motor brake signal can be mapped by Matrix-Output-Configuration table to a external periphery output. The following chart shows the MCD Standard-Profile motor safety braking sequence over the time.

4.3.1 Time chart



4.3.2 Time setting parameters

Legend	Description	SDO index, sub index
tr	Brake release, open time	Axis 1 0x2010.18 Axis 2 0x2020.18 Axis 3 0x2030.18
Ta_{nom}	Brake nominal activation time	Axis 1 0x2010.19 Axis 2 0x2020.19 Axis 3 0x2030.19
Ta_{max}	Brake maximal activation time	Axis 1 0x2010.1A Axis 2 0x2020.1A Axis 3 0x2030.1A

4.4 Autophasing

When Autophasing is being activated, Motion Control Mode 0 is selected automatically. While Autophasing is active, TxPDO.Control.Bit_3 is set. After completion, TxPDO.Control.Bit_3 is cleared and the previously used Motion Control Mode is activated again.

5 Motion-Control-Mode 0 Velocity / Torque Mode

5.1 RxPDO: Receive PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Control	TrqLim	Vel/Trq	Position

5.1.1 Control Command: Control

Bit 0..2 Mode 0..7 0 = Velocity / Torque mode
Bit 3 Set command input filter enable
Bit 4,5 Position reference mode 0..3
0: Position reference cycle disabled
1: Position reference cycle enable
2: Preset the reference position at current position immediately
3: Preset the reference position whit limit switch signal
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

5.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

5.1.3 Velocity / Torque Command: Vel/Trq

+/-32767 Velocity mode [$^1/_{min}$]
Torque mode [torque_high_res]

5.1.4 Position Value: Position

+/-PosRange Preset for the reference position [counts]

5.2 TxPDO: Transmit PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

5.2.1 Control Status: Status

Bit 0..2 Mode 0..7 0 = Velocity / Torque mode
Bit 3 Autophasing selected
Bit 4 Reference limit switch signal
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

5.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

5.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [$^1/_{min}$]

5.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

6 Motion-Control-Mode 1 Position Control Mode

6.1 RxPDO: Receive PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Control	TrqLim	Velocity	Position

6.1.1 Control Command: Control

Bit 0..2 Mode 0..7 1 = Position control mode
Bit 3 Set position input filter enable
Bit 4,5 Position reference mode 0..3
0: Position reference cycle disabled
1: Position reference cycle enable
2: Preset the reference position at current position immediately
3: Preset the reference position whit limit switch signal
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

6.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

6.1.3 Velocity Command: Velocity

0..32767 Reference position set : Set velocity for position control [$^{1}/_{min}$]
+/-32767 Reference position not set : Set velocity and direction [$^{1}/_{min}$]

6.1.4 Position Value: Position

+/-PosRange Reference position set : Set position for position control [counts]
+/-PosRange Reference position not set : Preset for the reference position [counts]

6.2 TxPDO: Transmit PDO for one axis of the MCD Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

6.2.1 Control Status: Status

Bit 0..2 Mode 0..7 1 = Position control mode
Bit 3 Position tolerance window reached
Bit 4 Reference limit switch signal
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

6.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

6.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [$^{1}/_{min}$]

6.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

7 Motion-Control-Mode 2 Profile Control Mode

7.1 RxPDO: Receive PDO for one axis of the MCD Module

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5..8
Control	TrqLim	ProfScale	ProfVel	Position

7.1.1 Control Command: Control

Bit 0..2 Mode 0..7 2 = Profile control mode
Bit 3 Variable profile set position
Bit 4, 5 Profile number 0..3
Bit 6 Clear error messages and switch motor on if axis enabled.
Bit 7 Axis enable, if no error exist motor will switch on.

7.1.2 Torque Limitation : TrqLim

0..127 Torque PWM output limitation [torque_low_res]

7.1.3 Profile Scale Factor : ProfScale

0..100 Set velocity [1/min] = Profile velocity * ProfScale / 100 [%]

7.1.4 Velocity outside profile range: ProfVel

0..255 Velocity command outside profile range [1/min]

7.1.5 Position Value: Position

+/-PosRange TxPDO.Control.Bit_3 = 0 no function
+/-PosRange TxPDO.Control.Bit_3 = 1 Variable profile set position [counts]

7.2 TxPDO: Transmit PDO for one axis of the MCD-Module

Byte 1	Byte 2	Byte 3,4	Byte 5..8
Status	Torque	Velocity	Position

7.2.1 Control Status: Status

Bit 0..2 Mode 0..7 2 = Profile control mode
Bit 3 Position tolerance window reached
Bit 4 Profile status
Bit 6 = 0: Set position outside profile table
Bit 6 = 1: Profile table not exits
Bit 5 Reference cycle done, reference position valid
Bit 6 Error exist
Bit 7 Axis enabled

7.2.2 Torque Output: Torque

+/-127 Torque PWM output [torque_low_res]

7.2.3 Actual Velocity: Velocity

+/-32767 Actuel velocity [1/min]

7.2.4 Position

+/- PosRange Actual position [counts]

Position Range: PosRange = 2147483647 * 2 / Resolver Pools

8 Error / Warning Messages

8.1 Module Errors / Warnings

8.1.1 Error Messages:

Index, sub index at object dictionary 2100[h] 01[h]

Bit	Message
0	1: Recovery resister circuit error
1	2: Over temperature at power supply
2	3: Aux.low voltage not ok +/-15V(GND)
3	4: Aux.high voltage not ok +/-15V(AT)
4	5: Over temperature at module
5..7	
8	7: System observation error exist
9..14	
15	16: Wrong DSP program version

8.1.2 Warning Messages

Index, sub index at object dictionary 2100[h] 02[h]

Bit	Message
0	1: Bus voltage out of range
1..7	
8	7: Copyright verification error
9..13	
14	15: RTC not set
15	16: RTC-Battery low

8.2 Axis Errors / Warnings

8.2.1 Error Messages

Index, sub index at object dictionary 2110[h] 01[h] Axis 1
Index, sub index at object dictionary 2120[h] 01[h] Axis 2
Index, sub index at object dictionary 2130[h] 01[h] Axis 3

Bit	Message
0	1: Motor phase / IGBT power failure
1	2: Resolver not connected
2	3: Motor over temperature
3	4: Motor load level stop
4	5: Drive load level stop
5	6: Bus voltage out of range
6	7: Axis input enable interrupted
7..12	
13	14: Axis parameter wrong
14	15: Motor parameter wrong
15	16: Drive parameter wrong

8.2.2 Warning Messages

Index, subindex at object dictionary 2110[h] 02[h] Axis 1
Index, subindex at object dictionary 2120[h] 02[h] Axis 2
Index, subindex at object dictionary 2130[h] 02[h] Axis 3

Bit	Message
0	1: Axis enable not present
1	2: Motor off
2	3: Resolver phasing is activated
3	4: Motor velocity error limit reached
4	5: Motor load level warning
5	6: Drive load level warning
6	7: Reference position not set

8.3 EMERGENCY Telegram

Emergency objects are triggered by the occurrence of a device internal error situation and are transmitted from an emergency producer on the device. Emergency objects are suitable for interrupt type error alerts. An emergency object is transmitted only once per 'error event'. As long as no new errors occur on a device no further emergency objects will be transmitted.

8.3.1 Transmit PDO structure :

Byte 1, 2	Byte 3	Byte 4..8
Error Code	Error Register	MCD manufacturer specific error field

8.3.2 Error Code :

[h]	Message
0000	Error reset or no error
1000	Generic module error For details see MCD manufacturer specific error field
1001	Generic axis 1 error For details see MCD manufacturer specific error field
1002	Generic axis 2 error For details see MCD manufacturer specific error field
1003	Generic axis 3 error For details see MCD manufacturer specific error field
1010	Generic user main application error For details see user application manufacturer specific error field documentation.
1011	Generic user axis 1 application error For details see user application manufacturer specific error field documentation.
1012	Generic user axis 2 application error For details see user application manufacturer specific error field documentation.
1013	Generic user axis 3 application error For details see user application manufacturer specific error field documentation.

8.3.3 Error Register :

Bit	Message
0	Generic error
1	Current
2	Voltage
3	Temperature
4	Communication error (overrun, error state)
5	Device profile specific
6	Reserved (always 0)
7	Manufacturer specific

8.3.4 MCD manufacturer specific error field :

Byte 4, 5	Byte 6	Byte 7, 8
MCD error register	MCD error additional Index	MCD error additional Value

8.3.4.1 MCD error register :

Error Code	MCD error register
1000	See Module Error Messages
1001	See Axis 1 Error Messages
1002	See Axis 2 Error Messages
1003	See Axis 3 Error Messages

8.3.4.2 MCD error additional Index, Value :

For debugging or special function it's possible to send together with the error message a additional 16 bit value with the corresponding index number (0..255).

8.4 Pre-define Error Field (Error History)

The object at index 1003h holds the errors that have occurred on the device and have been signaled via the Emergency Object. In doing so it provides an error history.

1. The entry at sub-index 0 contains the number of actual errors that are recorded in the array starting at sub-index 1.
2. Every new error is stored at sub-index 1, the older ones move down the list.
3. Writing a “0” to sub-index 0 deletes the entire error history (empties the array).
4. The error numbers are of type UNSIGNED32 and are composed of a 16 bit error code and a 16 bit additional error information field which is manufacturer specific. The error code is contained in the lower 2 bytes (LSB) and the additional information is included in the upper 2 bytes (MSB).

8.4.1 16 bit Error Code :

See : Error Code

8.4.2 16 bit Additional error information field :

See : MCD error register

9 IDBx-Module Connectors

9.1 IDBs-Module

9.1.1 J1-Connector I/O-Signals

Connector type at panel side : WAGO 231-450
Connector type at wiring side : WAGO 231-120/026-000

Pin	Definition	Description
1	ANALOG INP (+) 1	Differential analog input 1 ±10 Voltage range
2	ANALOG INP (-) 1	Differential analog input 1
3	ANALOG INP 2	Analog input 2 referred to ANALOG GND ±10 Voltage range
4	ANALOG OUT 1	Analog output 1 referred to ANALOG GND ±10 Voltage range
5	ANALOG OUT 2	Analog output 2 referred to ANALOG GND ±10 Voltage range
6	ANALOG GND	Analog ground for pin 3..5
7	+15VDC OUT	Output power supply +15 Voltage (I_{max} = 100 mA)
8	INPUT COMMON	Input power supply common for DIGITAL INPUT 0, 1, 2 signals
9	+24VDC INPUT	Input power supply +24 Voltage to drive the MODULE OK signal
10	MODULE OK	Digital output signal MODULE OK +24 Voltage (optoisolated)
11	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 0 signal
12	DIGITAL OUT 0	Digital output signal 0 +24 Voltage (optoisolated)
13	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 1 signal
14	DIGITAL OUT 1	Digital output signal 1 +24 Voltage (optoisolate)
15	DIGITAL INP 1	Digital input signal 1 +24 Voltage (optoisolated)
16	DIGITAL INP 0	Digital input signal 0 +24 Voltage (optoisolated)
17	MODULE RESET	Digital input signal for reset module +24 Voltage (optoisolated)
18	DIGITAL INP 2	Digital input signal 2 +24 Voltage (optoisolated)
19	GND	Connect to ground with >= 2.5 mm2
20	GND	Connect to ground with >= 2.5 mm2

9.1.2 J2-Connector RS485 Port Signals

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(+)Rx	Differential receive single
2	n.c.	
3	(+)Tx	Differential transmit signal
4	n.c.	
5	+5VDC(0V)	+5 VDC output power supply referred to 0 V
6	(-)Rx	Differential receive single
7	0V (logic)	0 V logic circuit
8	(-)Tx	Differential transmit signal
9	n.c.	

9.1.3 J3-Connector Encoder Outputs and I/O-Signals

Connector type at panel side : SUB-D 15 contacts, female
Connector type at wiring side : SUB-D 15 contacts, male

Pin	Definition	Description
1	DIGITAL INP 2	Digital input signal 2, referred to 0 V (logic) +5 VDC (not opto-isolated)
2	(-) B1	Differential encoder phase B, axis 1 output signal
3	(+) A1	Differential encoder phase A, axis 1 output signal
4	(+) C1	Differential encoder phase C, axis 1 output signal
5	-15VDC(0V)	-15 VDC output power supply referred to 0 V (I_{max} = 30mA)
6	+15VDC(0V)	+15 VDC output power supply referred to 0 V (I_{max} = 30mA)
7	DIGITAL INP 4	Digital input signal 4, referred to 0 V (logic) +5 VDC (not opto-isolated)
8	DIGITAL OUT 2	Digital output signal 2, referred to 0 V (logic) +5 VDC (not opto-isolated)
9	(+) B1	Differential encoder phase B, axis 1 output signal

10	(-) A1	Differential encoder phase A, axis 1 output signal	
11	(-) C1	Differential encoder phase C, axis 1 output signal	
12	DIGITAL INP 3	Digital input signal 3, referred to 0 V (logic)	+5 VDC (not opto-isolated)
13	DIGITAL Test Pin 1	Digital test pin 1 for DSP-Processor	+5 VDC (not opto-isolated)
14	DIGITAL Test Pin 2	Digital test pin 2 for DSP-Processor	+5 VDC (not opto-isolated)
15	0V (logic)	0 V logic circuit	

9.1.4 J4-Connector Resolver

Connector type at panel side : SUB-D 9 contacts, female
Connector type at wiring side : SUB-D 9 contacts, male

Pin	Definition	Description
1	(+) cos	Differential cosine input signal
2	(-) cos	Differential cosine input signal
3	Shield	Shield of twisted cable
4	(+) sin	Differential sinus input signal
5	(-) sin	Differential sinus input signal
6	PTC	Motor winding PTC resistor
7	0V (resolver)	0 V resover circuit
8	PTC	Motor winding PTC resistor
9	10kHz (resolver)	10 kHz, 20 Vpp output sinusoidal wave for supplying primary resolver winding

9.1.5 J20-Connector I/O-Port (LPT)

Connector type at panel side : MINI-SUB-D 20 contacts, female
Connector type at wiring side : MINI-SUB-D 20 contacts, male

Pin	Definition	Description	LPT-Connector SUB-D 25 contacts	
1	0V (logic)	0 V logic circuit	LPT Ground	18..25
2	I/O 8	Bi-directional data line 8	LPT Out (-)Strobe	1
3	I/O 0	Bi-directional data line 0	LPT Data 0	2
4	I/O 9	Bi-directional data line 9	LPT Out (-)Auto Line Feed	14
5	I/O 1	Bi-directional data line 1	LPT Data 1	3
6	I/O 10	Bi-directional data line 10	LPT Out (-)Initialisation	16
7	I/O 2	Bi-directional data line 2	LPT Data 2	4
8	I/O 11	Bi-directional data line 11	LPT Out (-)Select	17
9	I/O 3	Bi-directional data line 3	LPT Data 3	5
10	I/0 Interrupt	Interrupt line	LPT Inp (-)Acknowledge	10
11	I/O 4	Bi-directional data line 4	LPT Data 4	6
12	I/O 16	Bi-directional data line 16	LPT Inp (-)Error	15
13	I/O 5	Bi-directional data line 5	LPT Data 5	7
14	I/O 12	Bi-directional data line 12	LPT Inp (+)On line	13
15	I/O 6	Bi-directional data line 6	LPT Data 6	8
16	I/O 13	Bi-directional data line 13	LPT Inp (+)Paper empty	12
17	I/O 7	Bi-directional data line 7	LPT Data 7	9
18	I/O 14	Bi-directional data line 14	LPT Inp (-)Acknowledge	10
19	0V (logic)	0 V logic circuit	LPT Ground	18..25
20	I/O 15	Bi-directional data line 15	LPT Inp (+)Busy	11

9.1.6 J21-Connector CAN 1/2

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(-) can 2	Differential can 2 signal
2	(-) can 1	Differential can 1 signal
3	0V (logic)	0 V logic circuit
4	n.c.	
5	n.c.	
6	0V (logic)	0 V logic circuit
7	(+) can 1	Differential can 1 signal
8	(+) can 2	Differential can 2 signal
9	n.c.	

9.1.7 J22-Connector RS232 Port

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	-DCD	Data carrier dedect
2	RXD	Receive signal
3	TXD	Transmit signal
4	-DTR	Data terminal ready
5	0V (logic)	0 V logic circuit
6	-DSR	Data set ready
7	-TRS	Request to send
8	-CTS	Clear to send
9	-RI	Ring indikator

9.1.8 J24-Connector +24VDC Auxiliary Power Supply

Connector type at panel side : WAGO 231-432
Connector type at wiring side : WAGO 231-102/026-000

Pin	Definition	Description
1	+24 VDC	Input power supply +24 Voltage for drive internal auxiliary power supplies
2	-24 VDC	

9.2 IDBm-Module

9.2.1 J1-Connector Auxiliary Power Supply

Pin	Definition	Description
1	n.c.	
2	+18VDC(-HV)	+18 VDC input power supply referred to (-)High-Voltage-Bus
3	- HV	(-)High-Voltage-Bus
4	158kHz (±18V(-HV))	158 kHz square wave signal for drives IGBT-Power supply
5	n.c.	
6	n.c.	
7	+18VDC(0V)	+18 VDC input power supply referred to 0 V
8	-18VDC(0V)	-18 VDC input power supply referred to 0 V
9	+8VDC(0V)	+8 VDC input power supply referred to 0 V
10	+8VDC(0V)	+8 VDC input power supply referred to 0 V
12	0V (logic)	0 V logic circuit
13	0V (resolver)	0 V resolver circuit
13	10kHz (resover)	10 kHz input sinusoidal wave for supplying primary resolver winding

9.2.2 J2-Connector RS485 Port/Fault Signals

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(+)Rx	Differential receive single
2	n.c.	
3	(+)Tx	Differential transmit signal
4	Fault signal Bit 1	Power supply binary fault code, bit 1
5	+5VDC(0V)	+5 VDC output power supply referred to 0 V
6	(-)Rx	Differential receive single
7	0V (logic)	0 V logic circuit
8	(-)Tx	Differential transmit signal
9	Fault signal Bit 0	Power supply binary fault code, bit 0

9.2.3 J3-Connector Expansion Module

Connector type at panel side : SUB-D 15 contacts, female
Connector type at wiring side : SUB-D 15 contacts, male

Pin	Definition	Description
1	0V (logic)	0 V logic circuit
2	Aux. Voltage not ok	Auxiliary voltage at expansion module not ok
3	U-Current reference	Reference signal for phase U current
4	IGBT-Enable	Enable signal for IGBT-Power module
5	IGBT-Fault	Fault exist at IGBT-Power module
6	Over temperature	Over temperature at expansion module
7	Expansion pressent	Expansion module pressent
8	LED over temp.	Over temperature LED signal
9	Current gain Bit 1	Current control gain binary selector, bit 1
10	V-Current reference	Reference signal for phase V current
11	Current gain Bit 0	Current control gain binary selector, bit 0
12	n.c.	
13	HV-Bus not ok	High voltage bus not ok, out of tolerance
14	Aux. (-HV) not ok	Auxiliary voltage (-HT) at expansion module not ok
15	0V (logic)	0 V logic circuit

9.2.4 J4/5/6-Connector Resolver

Connector type at panel side : SUB-D 9 contacts, female
Connector type at wiring side : SUB-D 9 contacts, male

Pin	Definition	Description
1	(+) cos	Differential cosine input signal
2	(-) cos	Differential cosine input signal
3	Shield	Shield of twisted cable
4	(+) sin	Differential sinus input signal
5	(-) sin	Differential sinus input signal
6	PTC	Motor winding PTC resistor
7	0V (resover)	0 V resover circuit
8	PTC	Motor winding PTC resistor
9	10kHz (resover)	10 kHz, 20 Vpp output sinusoidal wave for supplying primary resolver winding

9.2.5 J7-Connector Encoder Outputs and I/O-Signals

Connector type at panel side : SUB-D 37 contacts, female
Connector type at wiring side : SUB-D 37 contacts, male

Pin	Definition	Description	
1	0V (logic)	0 V logic circuit	
2	(-) A1	Differential encoder phase A, axis 1 output signal	
3	(-) B1	Differential encoder phase B, axis 1 output signal	
4	(-) C1	Differential encoder phase C, axis 1 output signal	
5	(-) A2	Differential encoder phase A, axis 2 output signal	
6	(-) B2	Differential encoder phase B, axis 2 output signal	
7	(-) C2	Differential encoder phase C, axis 2 output signal	
8	(-) A3	Differential encoder phase A, axis 3 output signal	
9	(-) B3	Differential encoder phase B, axis 3 output signal	
10	(-) C3	Differential encoder phase C, axis 3 output signal	
11	DIGITAL Test Pin 2	Digital input test pin 2 for DSP-Processor	+5 VDC (not optoisolated)
12	ANALOG INP 6	Analog input 6	±10 Voltage range
13	ANALOG INP 5	Analog input 5	±10 Voltage range
14	ANALOG INP 4	Analog input 6	±10 Voltage range
15			
16	ANALOG INP (-) 3	Differential analog input 3	
17	ANALOG INP (-) 2	Differential analog input 2	
18	ANALOG INP (-) 1	Differential analog input 1	
19	+15VDC(0V)	+15 VDC output power supply referred to 0 V (I_{max} = 30mA)	
20	(+) A1	Differential encoder phase A, axis 1 output signal	
21	(+) B1	Differential encoder phase B, axis 1 output signal	
22	(+) C1	Differential encoder phase C, axis 1 output signal	
23	(+) A2	Differential encoder phase A, axis 2 output signal	
24	(+) B2	Differential encoder phase B, axis 2 output signal	
25	(+) C2	Differential encoder phase C, axis 2 output signal	
26	(+) A3	Differential encoder phase A, axis 3 output signal	
27	(+) B3	Differential encoder phase B, axis 3 output signal	
28	(+) C3	Differential encoder phase C, axis 3 output signal	
29	DIGITAL Test Pin 1	Digital input test pin 1 for DSP-Processor	+5 VDC (not opto-isolated)
30	Shield		
31	DIGITAL OUT 1	Digital output signal 1	+5 VDC (not opto-isolated)
32	DIGITAL OUT 2	Digital output signal 2	+5 VDC (not opto-isolated)
33	DIGITAL OUT 3	Digital output signal 3	+5 VDC (not opto-isolated)
34	ANALOG INP (+) 3	Differential analog input 3	±10 Voltage range
35	ANALOG INP (+) 2	Differential analog input 2	±10 Voltage range
36	ANALOG INP (+) 1	Differential analog input 1	±10 Voltage range
37	-15VDC(0V)	-15 VDC output power supply referred to 0 V (I_{max} = 30mA)	

9.2.6 J8-Connector I/O-Signals

Connector type at panel side : WAGO 231-450
Connector type at wiring side : WAGO 231-120/026-000

Pin	Definition	Description	
1	ANALOG OUT 1	Analog output 1 referred to ANALOG GND	±10 Voltage range
2	ANALOG OUT 2	Analog output 2 referred to ANALOG GND	±10 Voltage range
3	ANALOG OUT 3	Analog output 3 referred to ANALOG GND	±10 Voltage range
4	ANALOG OUT 4	Analog output 4 referred to ANALOG GND	±10 Voltage range
5	ANALOG OUT 5	Analog output 5 referred to ANALOG GND	±10 Voltage range
6	ANALOG OUT 6	Analog output 6 referred to ANALOG GND	±10 Voltage range
7	ANALOG GND	Analog ground for pin 1..8	
8	+15VDC OUT	Output power supply +15 Voltage (I_{max} = 100 mA)	
9	INPUT COMMON	Input power supply common for DIGITAL INPUT 0, 1, 2, 3 signals	
10	+24VDC INPUT	Input power supply +24 Voltage to drive the MODULE OK signal	
11	MODULE OK	Digital output signal MODULE OK	+24 Voltage (opto-isolated)
12	+24VDC INPUT	Input power supply +24 Voltage to drive the DIGITAL OUT 0 signal	
13	DIGITAL OUT 0	Digital output signal 0	+24 Voltage (opto-isolated)
14	DIGITAL INP 1	Digital input signal 1	+24 Voltage (opto-isolated)
15	DIGITAL INP 2	Digital input signal 2	+24 Voltage (opto-isolated)
16	DIGITAL INP 3	Digital input signal 3	+24 Voltage (opto-isolated)
17	DIGITAL INP 0	Digital input signal 0	+24 Voltage (opto-isolated)
18	MODULE RESET	Input signal for reset module	+24 Voltage (opto-isolated)
19	GND	Connect to ground with >= 2.5 mm2	
20	GND	Connect to ground with >= 2.5 mm2	

9.2.7 J20-Connector I/O-Port (LPT)

Connector type at panel side : MINI-SUB-D 20 contacts, female
Connector type at wiring side : MINI-SUB-D 20 contacts, male

Pin	Definition	Description	LPT-Connector SUB-D 25 contacts	
1	0V (logic)	0 V logic circuit	LPT Ground	18..25
2	I/O 8	Bi-directional data line 8	LPT Out (-)Strobe	1
3	I/O 0	Bi-directional data line 0	LPT Data 0	2
4	I/O 9	Bi-directional data line 9	LPT Out (-)Auto Line Feed	14
5	I/O 1	Bi-directional data line 1	LPT Data 1	3
6	I/O 10	Bi-directional data line 10	LPT Out (-)Initialisation	16
7	I/O 2	Bi-directional data line 2	LPT Data 2	4
8	I/O 11	Bi-directional data line 11	LPT Out (-)Select	17
9	I/O 3	Bi-directional data line 3	LPT Data 3	5
10	I/0 Interrupt	Interrupt line	LPT Inp (-)Acknowledge	10
11	I/O 4	Bi-directional data line 4	LPT Data 4	6
12	I/O 16	Bi-directional data line 16	LPT Inp (-)Error	15
13	I/O 5	Bi-directional data line 5	LPT Data 5	7
14	I/O 12	Bi-directional data line 12	LPT Inp (+)On line	13
15	I/O 6	Bi-directional data line 6	LPT Data 6	8
16	I/O 13	Bi-directional data line 13	LPT Inp (+)Paper empty	12
17	I/O 7	Bi-directional data line 7	LPT Data 7	9
18	I/O 14	Bi-directional data line 14	LPT Inp (-)Acknowledge	10
19	0V (logic)	0 V logic circuit	LPT Ground	18..25
20	I/O 15	Bi-directional data line 15	LPT Inp (+)Busy	11

9.2.8 J21-Connector CAN 1/2

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	(-) can 2	Differential can 2 signal
2	(-) can 1	Differential can 1 signal
3	0V (logic)	0 V logic circuit
4	n.c.	
5	n.c.	
6	0V (logic)	0 V logic circuit
7	(+) can 1	Differential can 1 signal
8	(+) can 2	Differential can 2 signal
9	n.c.	

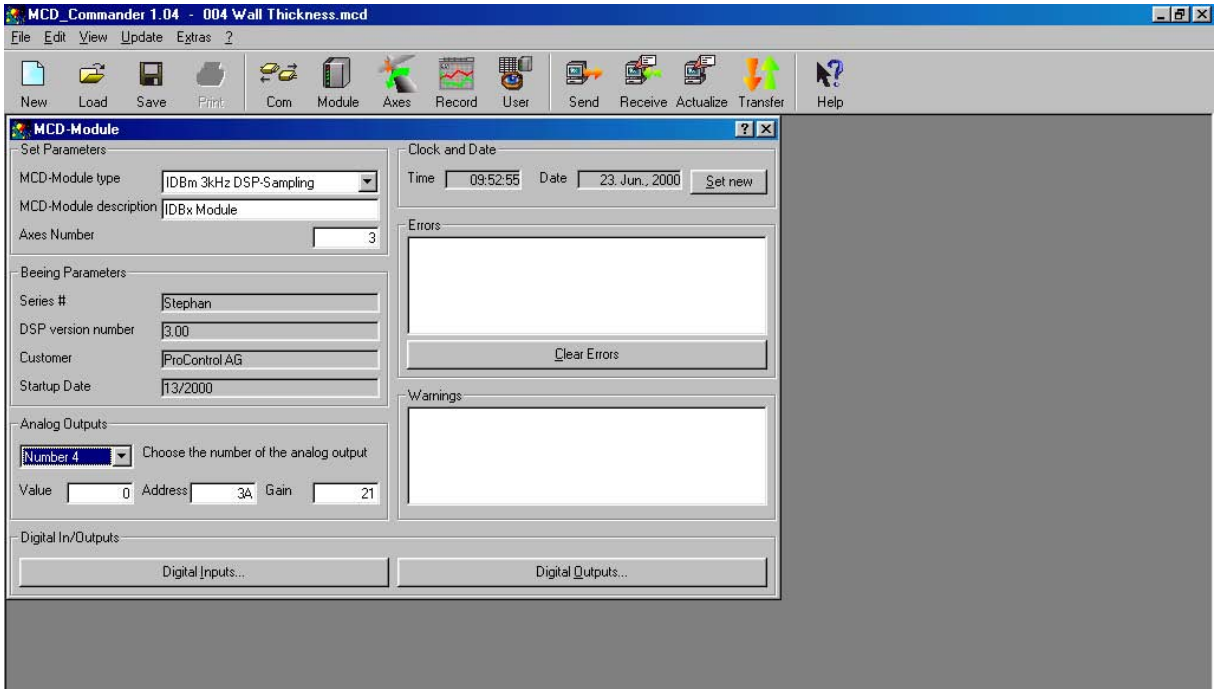
9.2.9 J22-Connector RS232 Port

Connector type at panel side : SUB-D 9 contacts, male
Connector type at wiring side : SUB-D 9 contacts, female

Pin	Definition	Description
1	-DCD	Data carrier dedect
2	RXD	Receive signal
3	TXD	Transmit signal
4	-DTR	Data terminal ready
5	0V (logic)	0 V logic circuit
6	-DSR	Data set ready
7	-TRS	Request to send
8	-CTS	Clear to send
9	-RI	Ring indikator

10 IDBx-Module Configuration

10.1 Analog Outputs



10.1.1 Configuration table

The analog outputs are configured by an address and a gain value. The gain value is a power number with the following effect. The actual value is multiplied by $2^{((Gain-16)/2)}$ and will be written to the specified output.
Address 0 ..4 allows to manually write to the outputs.

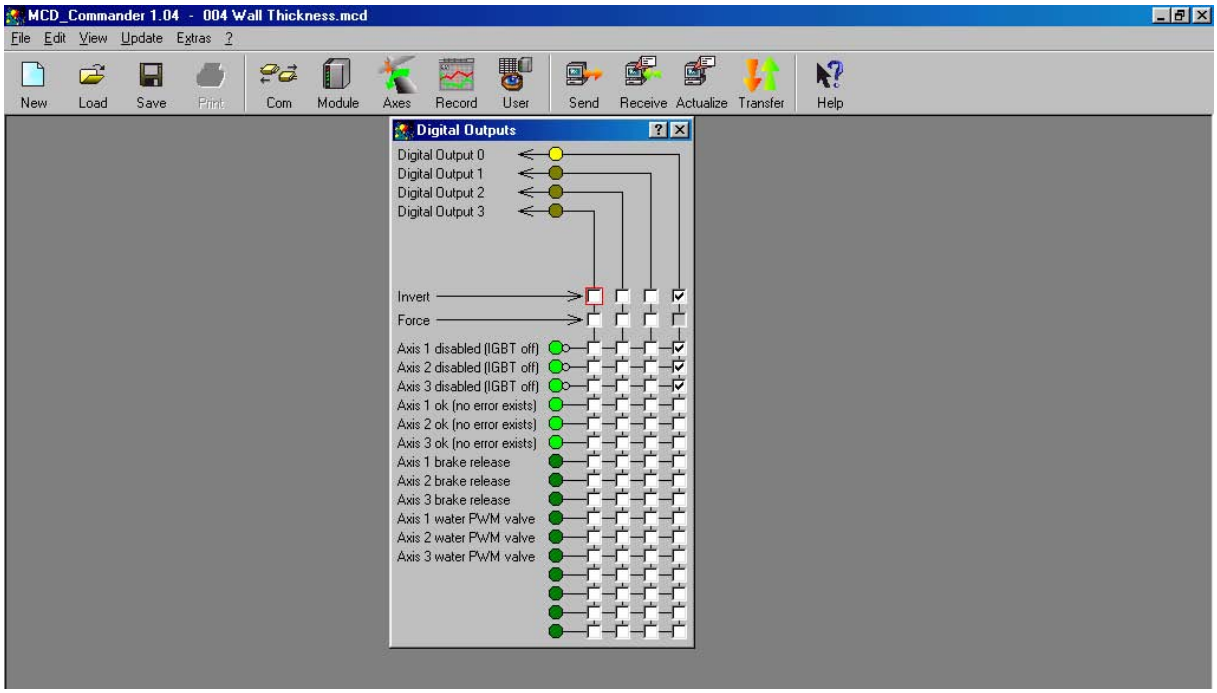
Address	Gain	Description
0x3A 0x3B 0x3C	21 21 21	**Axis 1: Filtered actual velocity** **Axis 2: Filtered actual velocity** **Axis 3: Filtered actual velocity** 2pol Resolver : 10 Volt = 15'910 [rpm] 4pol Resolver : 10 Volt = 7'955 [rpm] 6pol Resolver : 10 Volt = 5'303 [rpm] 8pol Resolver : 10 Volt = 3'977 [rpm]
0x37 0x38 0x39	16 16 16	**Axis 1: Output current command** **Axis 2: Output current command** **Axis 3: Output current command** 10 Volt = 100% of maximum drive current
0x00 0x01 0x02 0x03 0x04	 15 16 17	**User output value** Value : 23169 = 10 Volts Value : 32767 = 10 Volts Value : 46339 = 10 Volts

10.1.2 IDBx-Modules and DSP-Versions specific definition

The following analog outputs are exist at different IDBx modules and will be supported at different DSP-Versions.

Modul	DSP-Version	Description
IDBs		ANALOG OUT 1, 2
IDBm	bis 02.99	ANALOG OUT 4, 5
	ab 03.00	ANALOG OUT 1..6

10.2 Digital Outputs



10.2.1 Matrix-Output-Configuration table

The physical digital outputs are configured by a matrix table. There are internal matrix input signals which can be selected to the matrix outputs. If the inverter function is selected the matrix output will be inverted written to the physical output.
If no matrix mask for a digital output selected, it is allows to manually write to the output.

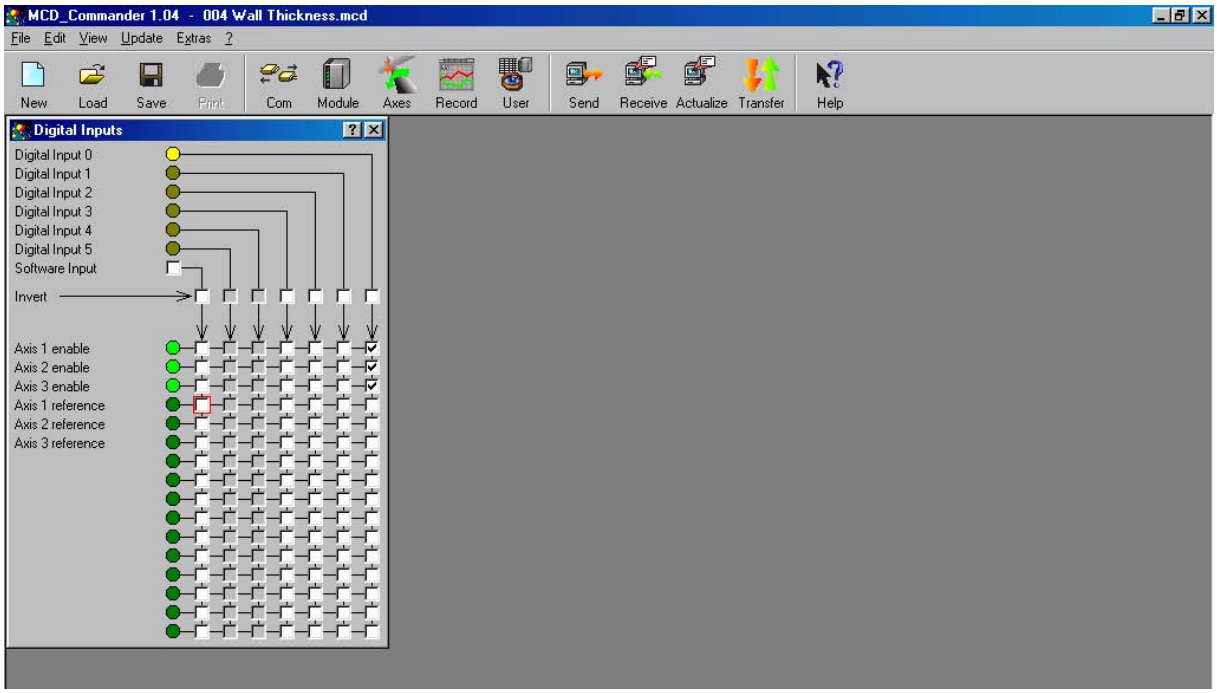
Matrix-Inputs	Matrix-Bit-Mask	Description
Ax_1 disabled	0000'0000'0000'0001	Axis 1: disabled, IGBT off
Ax_2 disabled	0000'0000'0000'0010	Axis 2: disabled, IGBT off
Ax_3 disabled	0000'0000'0000'0100	Axis 3: disabled, IGBT off
Ax_1 ok	0000'0000'0000'1000	Axis 1: No error exist at axis
Ax_2 ok	0000'0000'0001'0000	Axis 2: No error exist at axis
Ax_3 ok	0000'0000'0010'0000	Axis 3: No error exist at axis
Ax_1 brake	0000'0000'0100'0000	Axis 1: Motor safety brake open signal
Ax_2 brake	0000'0000'1000'0000	Axis 2: Motor safety brake open signal
Ax_3 brake	0000'0001'0000'0000	Axis 3: Motor safety brake open signal
Ax_1 water valve	0000'0010'0000'0000	Axis 1: PWM output for water motor cooling valve
Ax_2 water valve	0000'0100'0000'0000	Axis 2: PWM output for water motor cooling valve
Ax_3 water valve	0000'1000'0000'0000	Axis 3: PWM output for water motor cooling valve

10.2.2 IDBx-Modules specific definition

The following physical digital outputs are exist at different IDBx modules.

Modul	Connecter	Description		
IDBs	J1 Pin 12	DIGITAL OUT 0	+24 VDC (optoisolated)	default:: AXIS DISABLED
	J1 Pin 14	DIGITAL OUT 1	+24 VDC (optoisolated)	
	J3 Pin 8	DIGITAL OUT 2	+5 VDC (not optoisolated)	
IDBm	J7 Pin 13	DIGITAL OUT 0	+24 VDC (optoisolated)	default:: AXES DISABLED
	J7 Pin 31	DIGITAL OUT 1	+5 VDC (not optoisolated)	
	J7 Pin 32	DIGITAL OUT 2	+5 VDC (not optoisolated)	
	J7 Pin 33	DIGITAL OUT 3	+5 VDC (not optoisolated)	

10.3 Digital Inputs



10.3.1 Matrix-Input-Configuration table

The physical digital inputs are configured by a matrix table. There are internal matrix output signals which can be selected to the matrix inputs. If the inverter function is selected the physical input will be inverted written to the matrix table.

Matrix-Outputs	Matrix-Bit-Mask	Description
Ax_1 enable	0000'0000'0000'0001	Axis 1: Enable for switch axis on
Ax_2 enable	0000'0000'0000'0010	Axis 2: Enable for switch axis on
Ax_3 enable	0000'0000'0000'0100	Axis 3: Enable for switch axis on
Ax_1 reference	0000'0000'0000'1000	Axis 1: Reference limit switch signal
Ax_2 reference	0000'0000'0001'0000	Axis 2: Reference limit switch signal
Ax_3 reference	0000'0000'0010'0000	Axis 3: Reference limit switch signal

10.3.2 IDBx-Modules specific definition

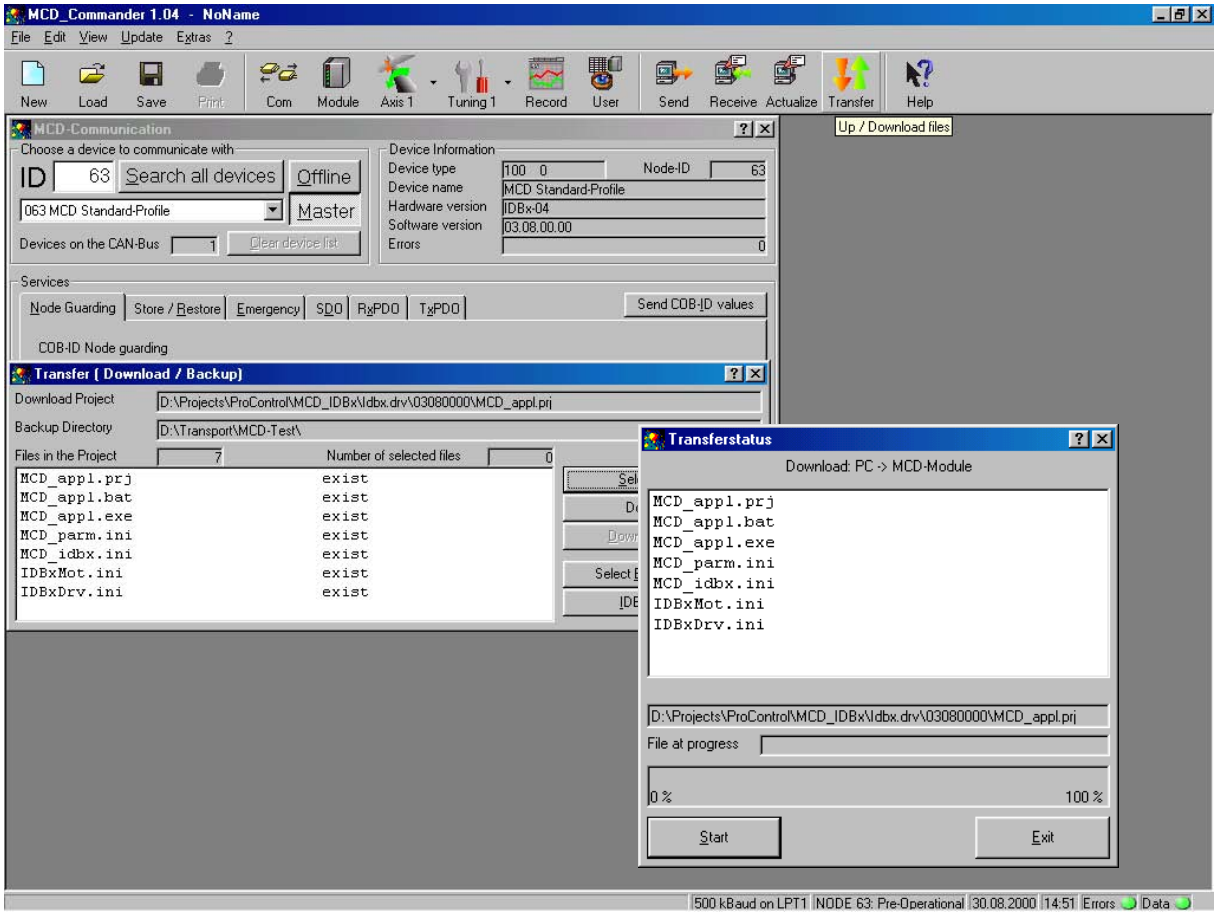
The following physical digital inputs are exist at different IDBx modules.

Modul	Connecter	Description		
IDBs	J1 Pin 16	DIGITAL INP 0	+24 VDC (optoisolated)	default:: AXIS 1 ENABLE
	J1 Pin 15	DIGITAL INP 1	+24 VDC (optoisolated)	
	J1 Pin 18	DIGITAL INP 1	+24 VDC (optoisolated)	
	J3 Pin 1	DIGITAL INP 2	+5 VDC (not optoisolated)	
	J3 Pin 12	DIGITAL INP 3	+5 VDC (not optoisolated)	
	J3 Pin 7	DIGITAL INP 4	+5 VDC (not optoisolated)	
IDBm	J8 Pin 17	DIGITAL INP 0	+24 VDC (optoisolated)	default: AXIS 1..3 ENABLE
	J8 Pin 14	DIGITAL INP 1	+24 VDC (optoisolated)	
	J8 Pin 15	DIGITAL INP 2	+24 VDC (optoisolated)	
	J8 Pin 16	DIGITAL INP 3	+24 VDC (optoisolated)	

11 Project Up- / Download

Following the step by step instructions for project up- or download.

11.1 MCD-Commander



11.1.1 Upload/Backup

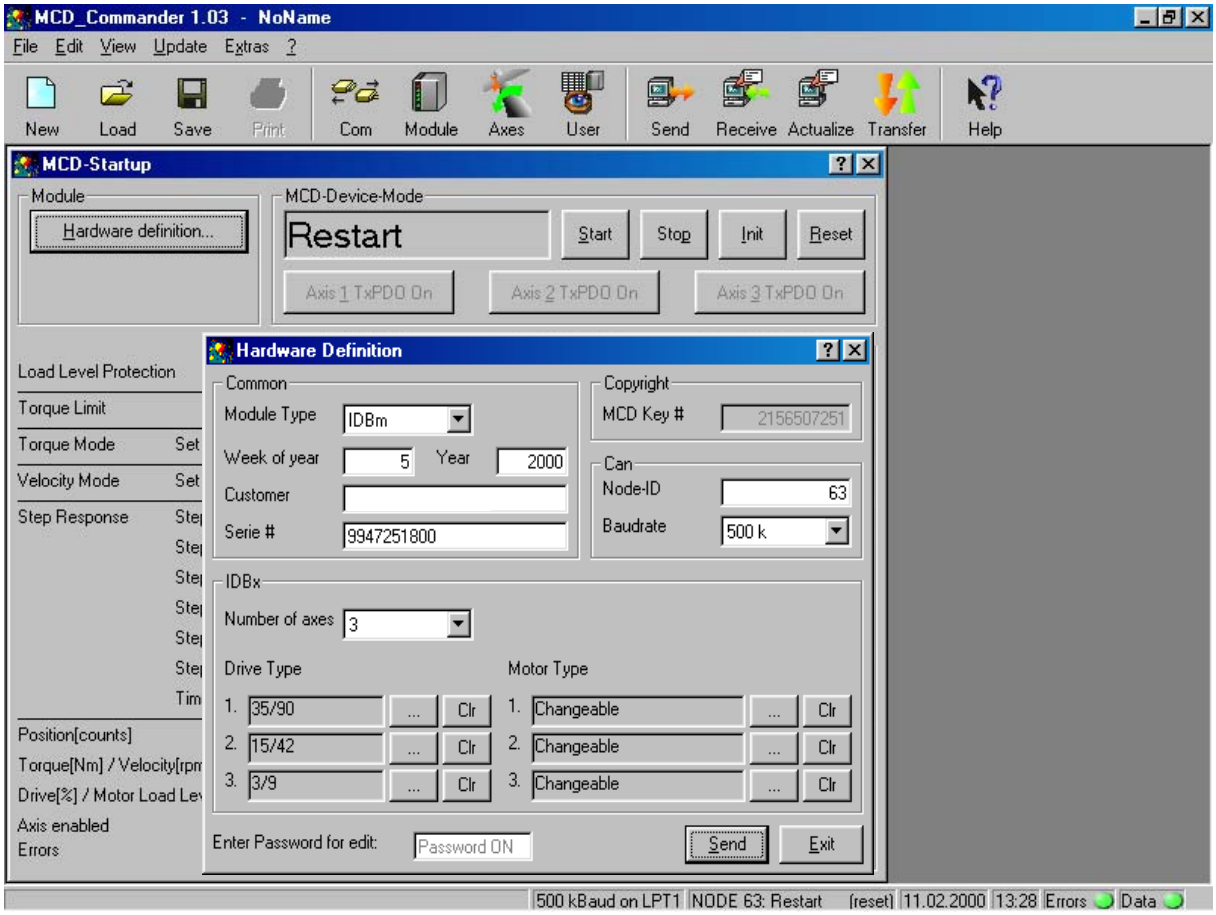
- Start the MCD-Commander and select the IDBx-Module with the right ID number (default 63)
- Select Transfer-Popup (Ctrl & F4) and press ***Select Backup Directory*** to select the directory to store the project files.
- Press ***IDBx Backup*** to activate project upload.
- Press ***Start*** to start the project upload transferring.

11.1.2 Download

- Start the MCD-Commander and select the IDBx-Module with the right ID number (default 63)
- Select Transfer-Popup (Ctrl & F4) and press ***Select Project…*** to select the project directory where the right project is stored with the existing ????.PRJ file.
- Press ***Download All*** to select all project files download.
- Press ***Start*** to start the project download transferring.
- After completely download press ***Reset*** for restart the IDBx-Module. If was't before a MCD-Profile compatible project installed, press the reset button at IDBx-Module.

12 Hardware-Definition

On the MCD-Startup side (MCD-Commander) there is the button to define the hardware. To change the hardware parameter the Device must be in the Restart, Pre-Operational or Preparing mode. For edit the hardware the password must be set. If all hardware parameter defined press the button ***send*** for download the new definition. The new definition will be valid after a IDBx-Module reset.



6. RESTART INTERLOCK CIRCUIT (Optional)

6.1 SAFETY REQUIREMENTS

- **Controlled Stop Time**. The final machine must be able to stop the motors in less than 360 ms. The hazard/risk assessment of the application must demonstrate that within this time persons cannot be injured. The drive can provide the Anti Free Wheeling function to perform the controlled stop.

- **Free-Wheeling Detection**. The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. This system must have the motor velocity available.

  WARNING*: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

- **Environmental Conditions.** Equipment intended to operate within the following environmental conditions:
  - ◊ Ambient temperature: 0 to 40°C
  - ◊ Supply voltage interruptions: 10, 20, 500 ms dip time
  - ◊ EMC immunity: according to EN 61000-6-2:1999 (Generic Standard - Immunity for industrial environment)
  - ◊ Vibration: 5 to 9Hz, 3.0 mm amplitude (peak); 9 to 200Hz, 1 g acceleration
  - ◊ Shock: 10 g, half sine, 6 ms

- **Enlosure.** Electronic Equipment intended for installation in an enclosure providing at least IP54 protection.

- **Pollution Degree 2 Installation** - The equipment shall be placed in a pollution degree 2 environment, where normally only non-conductive pollution occurs. Occasionally, however, a temporary conductivity caused by condensation is to be expected, when the electronic equipment is out of operation.

- ***WARNING****: When the Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

6.2 RESTART INTERLOCK FUNCTION

The "Restart Interlock" function is included in the drive modules as an option.

The power feed from the converter to the motor is interrupted with the restart interlock (motor rotation). This is based on standard EN 60204-1:1997.

The restart interlock prevents motor unexpectedly starting from standstill. This circuit macro can be used in the "Safe stand-still" machine function. However, beforehand, a complete standstill must be achieved and ensured using the external machine control.

This is especially valid for vertical axes without any self-locking mechanical system or without weight equalization.

The dual-channel restart interlock circuit has been validated by demonstrating that a single fault does not lead to the loss of the safety function (Category 3 according to EN 954-1:1996). The remaining risk is in this case, if two errors/faults occur simultaneously in the power section; the motor briefly rotates through a small angle (Fastact motors: 6-pole 60°, 8-pole 45°, 12-pole 30°, 16-pole 22.5°).
The marking DRC identifies the dual-channel restart interlock circuit.

A single-channel restart interlock circuit is also available as an option when only Category 2, according to EN-954-1:1996, is required. With this circuit a single fault can lead to the loss of the safety function. The marking SRC identifies the single-channel restart interlock circuit.

The restart interlock function does not provide electrical isolation. It does not provide protection against "electric shock".

The complete machine or system must always be electrically isolated from the line supply through the main disconnection device (main switch) before any work is carried out on the machine or system, e.g. maintenance, service or cleaning work (refer to EN 60204-1:1997, par. 5.3).

When correctly used, the restart interlock function must be looped in in the line contactor circuit or EMERGENCY STOP circuit. The associated drive must be electrically isolated from the supply if the restart interlock relay function is not plausible, referred to the machine operating mode. The restart interlock and the associated operating mode may only be used again after the fault has been removed.

As a result of a hazard analysis/risk analysis which must be carried out according to the Machinery Directive 98/37/EC modified and referring to standards EN 292 1/2; EN 954-1; and EN 1050, the machinery manufacturer must configure the safety circuit for the complete machine taking into account all of the integrated components for his machine types and versions of them. This also includes the electric drives.

6.3 DUAL-CHANNEL RESTART INTERLOCK CIRCUIT

***WARNING**: When the Dual-Channel Restart Interlock Circuit is activated, the motor can no longer generate a torque. Motors which are not automatically clamped when powered down (e.g. vertical/inclined axes), must be clamped using a mechanical brake*

Three redundant interlocking devices with mutual observation acting on the input power as well as on the signal path to the power control devices.

6.3.1 INTERLOCKING SYSTEM I AND II

Interlocking System I and Interlocking System II are in series. Each of the two Channels disconnects the auxiliary power supply for all the IGBT. A self contained auxiliary contactor disconnects the **Module Enable** signal when Interlocking System I or Interlocking System II becomes active.

For observing Interlocking System the input signal Channel 1 door and the output signal Channel 1 verification must be checked to have the appropriate status under the following conditions:

Channel 1 door = 0	Channel 1 verification = 1
Channel 1 door = 0->1	Channel 1 verification (after a delay of max 100 ms) = 0
Channel 1 door = 1	Channel 1 verification = 0
Channel 1 door = 1->0	Channel 1 verification (after a delay of 600 ms ± 100 ms) = 1

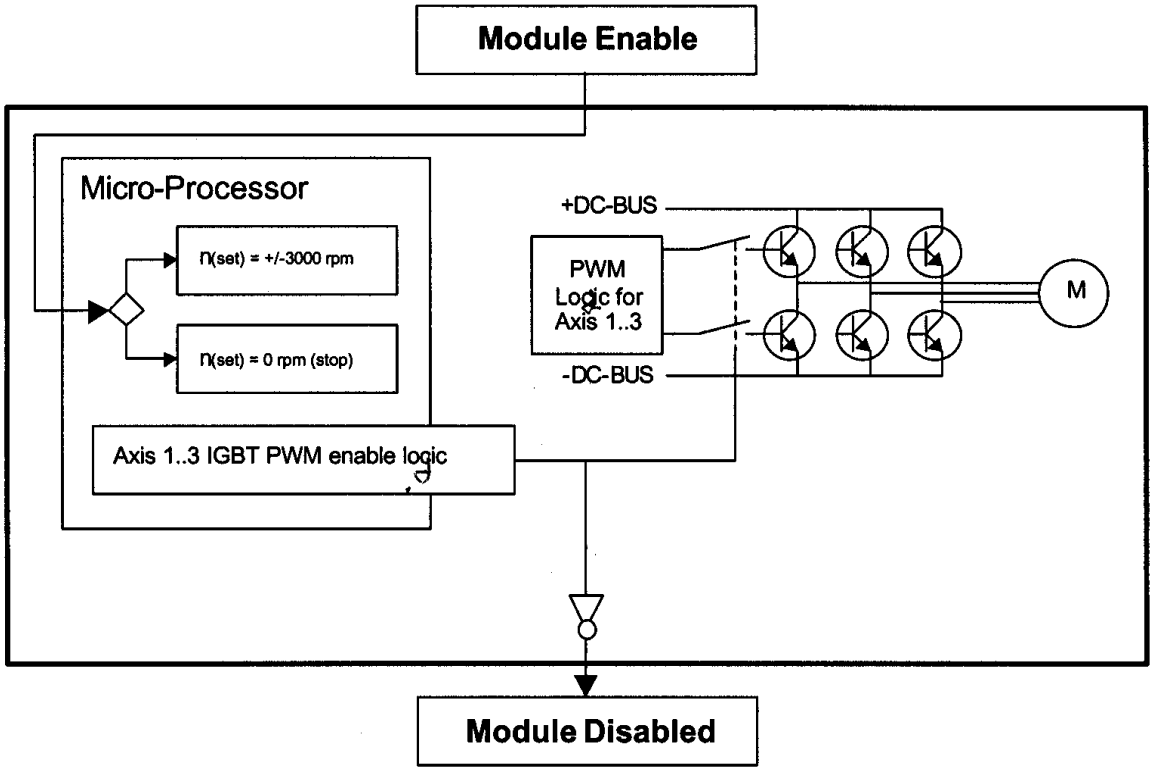
The same applies to Channel 2.

When monitoring a wrong signal status, the line contactor must disconnect the drive supply (see par.6.5). An error message must be available to make the malfunction of the safety circuit visible.

6.3.2 INTERLOCKING SYSTEM III

Interlocking System III interrupts the signal path based on the Module Enable signal. The control changes automatically to velocity control, whereas the set velocity becomes zero.As soon that all axes are at complete stop and all IGBT PWM Enable signals are switched off, the signal Module Disabled becomes active.
The Module Disabled signal is available at pos.13 of J7 connector.

Fig. 6.1 INTERLOCKING SYSTEM III



For observing Interlocking System III the input signal Module Enable and the output signal Module Disabled must be checked to have the appropriate status under the following conditions:

Module Enable = 0	Module Disabled = 1
Module Enable = 0->1	Module Disabled (after a delay of max 50 ms) = 0
Module Enable = 1	Module Disabled = 0
Module Enable = 1->0	Module Disabled (after a delay of 380 ± 20 ms) = 1

When monitoring a wrong signal status, the line contactor must disconnect the drive supply (see par.6.5). An error message must be available to make the malfunction of the safety circuit visible.

6.4 RESTART INTERLOCK CONNECTIONS

The restart interlock circuit is controlled using the JS1 connector on the front panel.

Tab. 6.1 - Module - JS1 Connector - RIC (Restart Interlock Circuit)
Panel side: male socket, 12 contacts, series 581 by Binder (Moog code AK5500)
Wiring side: female cable connector, 12 contacts, series 680 by Binder (Moog code AK4500)

Pos.	Name	Function
A	+ Channel 2 door	Input to bobbin of the first relay of Channel 2 from door/gate. With the door closed, this input is high (+24Vdc). When the door is opened this input changes to low (0V). The switch off time delay for the safety relay of Channel 2 is invoked. Additionally this opens the module enable contact
B	+ Channel 1 door	Input to bobbin of the first relay of Channel 1 from door/gate. With the door closed, this input is high (+24Vdc). When the door is opened this input changes to low (0V). The switch off time delay for the safety relay of Channel 1 is invoked. Additionally this opens the module enable contact
C	GND	Ground common to the above mentioned bobbins. This ground must be referred to 0V(logic) or floating
D	Module Enable	Series of NO contacts of Channel 1 and Channel 2. These contacts must be connected in series to the Module Enable input wiring. This way, when a door is opened, also the Interlock System III is activated.
E		
F	Channel 1 Verification	NC contact of the safety relay of Channel 1. Feedback of RIC. When closed (high), the Restart Interlock function is active. The external verification system must monitor this output signal for plausibility with its input signal and for comparison with the status of Channel 2 and Module Disabled signal (redundancy verification)
G		
H	Channel 2 Verification	NC contact of the safety relay of Channel 2. Feedback of RIC. When closed (high), the Restart Interlock function is active. The external verification system must monitor this output signal for plausibility with its input signal and for comparison with the status of Channel 1 and Module Disabled signal (redundancy verification)
J		
K	N.C.	
L	N.C.	
M	N.C.	

Note: *with the single-channel RIC, only Channel 1 is active. The positions related only to Channel 2 are not connected.*

The external cable to JS1 connector must be fail-safe according to prEN 954-2.
The Restart Interlock relays are controlled using the external +24Vdc (pos.A + terminal for Channel 2, pos.B + terminal for Channel 1, pos.C - terminal for both Channels).
When the Channel 2 relays are de-energized, the H-J terminals are closed-circuit and the Restart Interlock Channel 2 is activated. When the Channel 1 relays are de-energized, the F-G terminals are closed-circuit and the Restart Interlock Channel 1 is activated.
The D-E signal contact open actives the “Interlock System III”.

WARNING*: this circuit must be protected against overload and short-circuit using a fuse rated max 2A.*

6.5 SEQUENCE AND PROCEDURE USING THE RESTART INTERLOCK

The motor must be stopped before “+Channel 1 door” and/or “+Channel 2 door” are inhibited and the Restart Interlock is activated.

WARNING*: If a fault occurs when actuating the Restart Interlock, then this fault must be removed before the mechanically isolating protective guards to the working zone of the machine or plant are opened. After the fault has been removed, this procedure must be repeated for the Restart Interlock. Under fault conditions, alI of the drives, machine and plant must be shut down.*

If one of the following faults should occur with “+Channel 1 door” or “+Channel 2 door” de-energized and the protective guards withdrawn, then the EMERGENCY STOP must be immediately initiated:

- The acknowledgement contacts “Channel 1 verification” or “Channel 2 verification” remains open, the Restart Interlock is not activated.
- There is a wrong Module Disabled signal status.
- There is a fault in the external control circuit itself.
- There is a fault in the signal lines of the acknowledge contacts.

AlI of the drives associated with the machine/plant must be disconnected and isolated from the line supply through the line contactor. The de-energized status of the contactor must be monitored.

WARNING*: the line contactor must have a NC contact linked to safety NO contacts.*

If the Restart Interlock control has been correctly integrated into the external safety-related drive control and has been checked to ensure correct functioning, then the drives in the separate working zone of the machine are protected against undesirable starting, and personnel can enter or operate in the hazardous zone which has been defined.

CAUTION: *where the equipment requires manual intervention the relevant regulations must be taken into account*

6.6 ANTI FREEWHEELING STOP FUNCTION

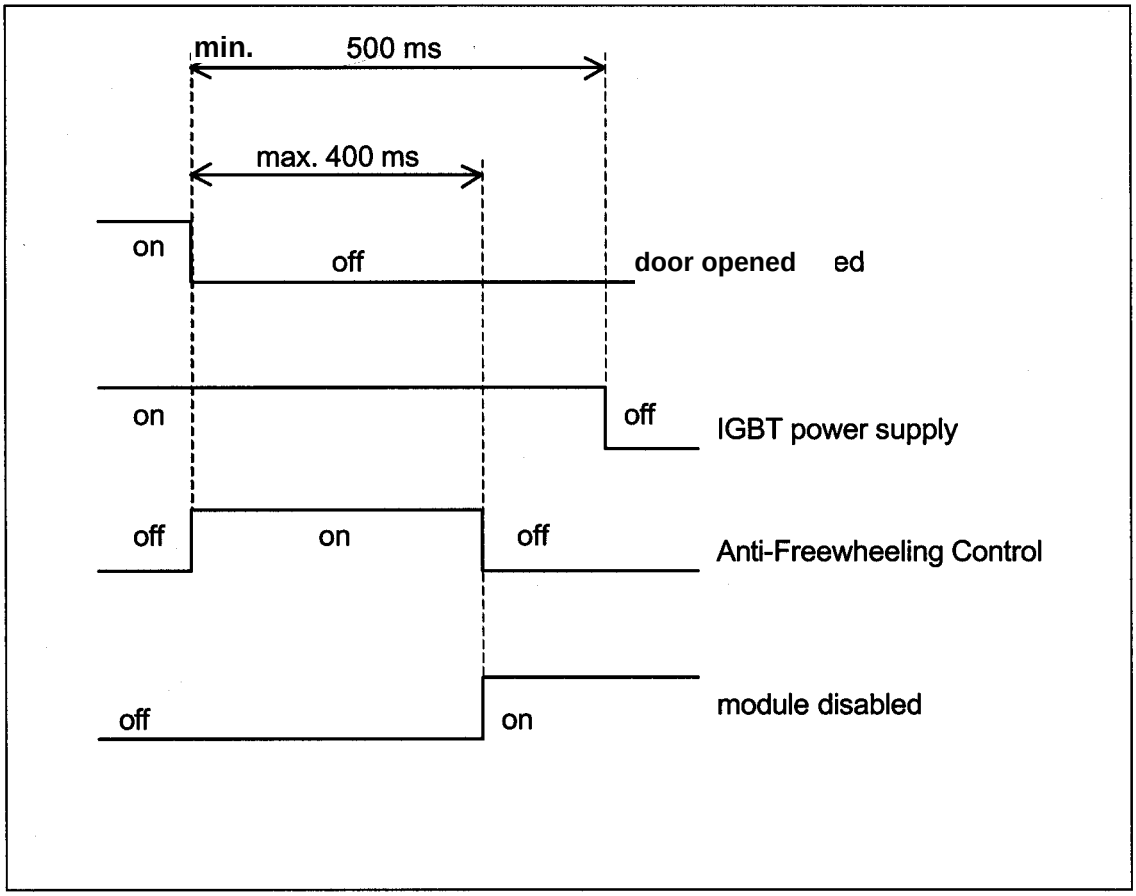
The Anti Freewheeling Stop Function is integrated in the RIC function. This means that, when this function is activated, a motor in movement performs a controlled stop according to Category 1 of EN60204-1:1997, 9.2.2. This function is still alive also in case of power shut down.

***WARNING**: The designer must evaluate the machine stopping time during the risk assessment even in case of failure. The machine can present a dangerous overrun in case of failure of the drive. Other protective measure are needed to achieve a safe condition.*

Integrated in the Restart Interlock function, the Anti Freewheeling Stop Sequence is:

- The closed safety gate is opened while the motor is stili moving
- The Module Enable signal is then switched off via the axis enable signals (D-E contacts of connector JS1)
- The microprocessor (Iatches the stop request and) performs a controlled antifreewheeling stop
- Aiso the hardware timer starts to provide the extra (min) 500 ms to allow the braking
- The IGBT are turned off via software (Interlocking System III) when the motion has stopped (but at the latest within 360 ms) to allow the switching off of PWM logic for the IGBTs
- The output signal Module Disabled switches on
- The hardware timer elapses and the power supply to the IGBT is turned off on both the Channel 1 and Channel 2 (Interlocking System I and II)
- The outputs “Channel 2 verification” and “Channel 1 verification” switch on

Fig. 6.4 Anti Freewheeling Timing Chart



6.7 CHECKING THE RESTART INTERLOCK

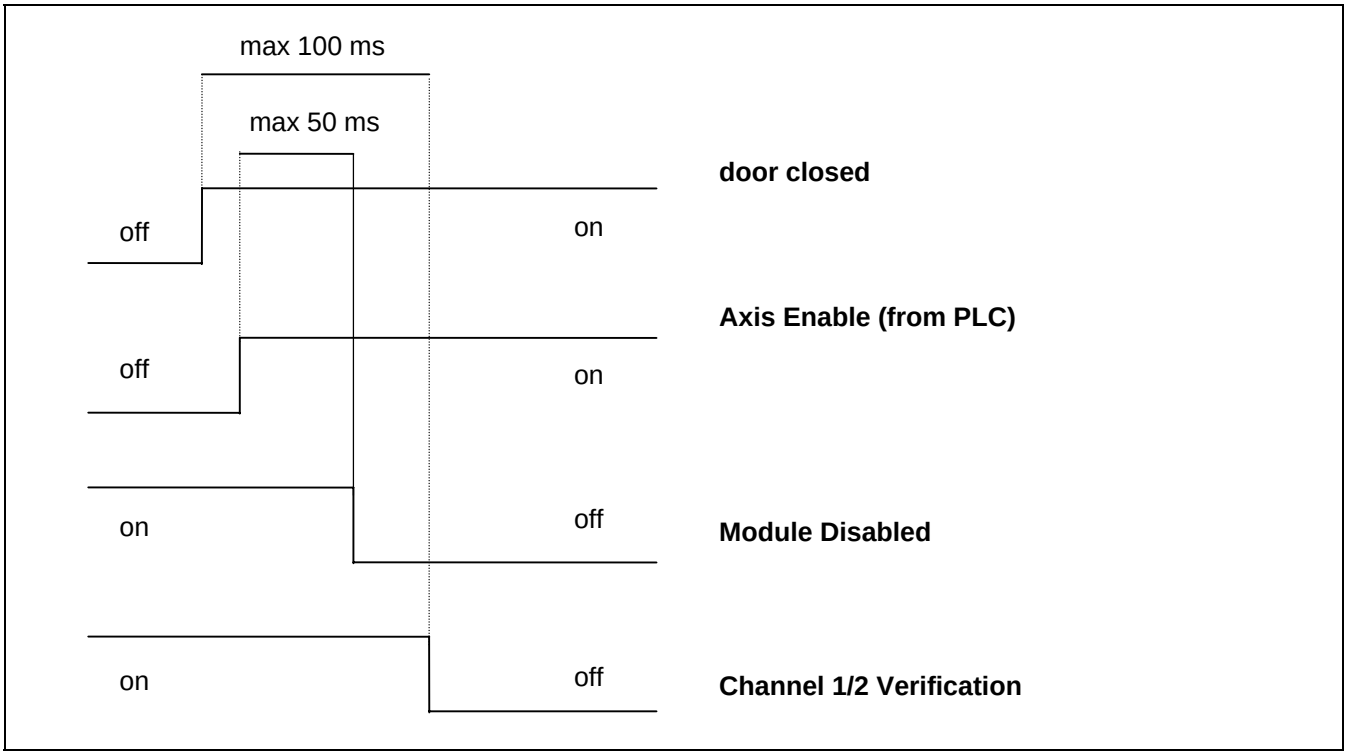
The following checks must always be made at the first start-up and when possible must be repeated at certain intervals during the operating lifetime.
A check should also be made after longer production standstills. Each individuai module must be checked.
The check must be made by qualified personnel taking into account the necessary safety measures:

- The IGBT drivers must be inhibited by withdrawing the voltage at positions A-C (Channel 2 door) and B-C (Channel 1 door) of JS1 connector. Furthermore, the acknowledge contacts J-H (Channel 2 verification) and F-G (Channel 1 verification) of JS1 connector of the Restart Interlock must close after a delay of 600 ± 100 ms. The drive then does not provide output current.
- Disabling the protective devices, e.g. opening the protective doors while the drive is running. The motor must be braked in a time < 360 ms and then powered down. This must not result in a hazardous condition.
- AII possible fault situations, which could occur, must be individually simulated in the signal lines between the verification contacts and the external control as well as the signal plausibility functions of this control e.g. by disconnecting the Restart Interlock monitoring circuit at positions J-H and F-G of JS1 connector.
- The timing chart of the antifreewheeling function must be verified (see fig.6.4)

For aII of the simulated fault situations, the line contactor must disconnect aII of the machine or plant drives from the line supply.

The correct starting sequence shown in Fig.6.5 must be checked to verify external faults (e.g. wiring short circuit at terminals Channel Verification F-G and H-J).

Fig. 6.5 Starting Sequence Timing Chart



6.8 EXTERNAL PLAUSIBILITY TESTS

The following tests of plausibility must be made outside of the drive (e.g. by a PLC).

- The external system must be able to detect free-wheeling when the axis does not stop within 360 ms after the Module Enable signal goes away. The information about the motor velocity is available at J21 connector CAN 1/2

- Channel 1 verification. The external system must monitor this output signal for plausibility with its input signal (see par.6.3.2) and for comparison with the status of Channel 2 and with the status of Module Disabled (redundancy verification)

- Channel 2 verification. The external system must monitor this output signal for plausibility with its input signal (see par.6.3.1) and for comparison with the status of Channel 1 and with the status of Module Disabled (redundancy verification)

- Module Disabled. The external system must monitor this output signal for plausibility with its input signal (see par.6.3.3) and for comparison with the status of Channel 1 and with the status of Channel 2 (redundancy verification)

- **Monitoring by a standard Programmable Electronic System**

- Minimum functional requirements
  - The automatic monitoring shall, at discovered fault, disconnect the line contactor and prevent a new start until fault has been removed
  - The change of the monitoring signal shall be checked automatically:
    - at the start up and
    - during each stopping (Fig. 6.4) and starting (Fig. 6.5) sequence.

- Wiring requirements to avoid common mode failures
  - Each signal shall be connected to its own input module or
  - If a single input module is used the signals of antivalent logic from different position switches shall be inputted as well.

- Software verification
  - Following safety related principles, it is necessary to verify the software and give instructions on periodic maintenance

- Modification of software
  - The manufacturer shall write a warning in the software close to the part of program concerning the monitoring that this part must not be deactivated or modified for safety reasons (see also clause 3.7.7 of EN 292-2)

- Other requirements
  - The output of the PLC to the line contactor shall be periodically tested by monitoring the plausibility of the NC contact of the line contactor

- Protection of program
  - The program shall be monitored by e.g. a watchdog
  - The program shall be in permanent memory protected against electrical interference and shall be equipped with a start-up test procedure

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